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SELECTED WATER RESOURCES ABSTRACTS

A monthly publication of the Geological Survey
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The Secretary of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

PREFACE

Selected Water Resources Abstracts, a monthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. These documents cover water resources as treated in the life, physical, and social sciences and the related engineering and legal aspects of the characteristics, supply condition, conservation, control, use, or management of water resources. Each abstract includes a full bibliographic citation and a set of descriptors which are listed in the **Water Resources Thesaurus.** The abstract entries are classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the then Federal Council for Science and Technology.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientitsts, engineers, and managers as one of several services of the Water Resources Scientific Information Center. The cumulative SWRA file from 1968 and monthly updates are available also in magnetic tape through lease from NTIS.

THE WATER RESOURCES SCIENTIFIC INFORMATION CENTER DOES NOT PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Water Resources Scientific
Information Center
U.S. Geological Survey, MS 421
Reston, VA 22092

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03 WATER SUPPLY AUGMENTATION AND CONSERVATION

Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

04 WATER QUANTITY MANAGEMENT AND CONTROL

Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Nonwater Activities; Watershed Protection.

05 WATER QUALITY MANAGEMENT AND PROTECTION

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06 WATER RESOURCES PLANNING

Includes the following Groups: Techniques of Planning; Evaluation Process; Cost Allocation, Cost Sharing, Pricing/Repayment; Water Demand; Water Law and Institutions; Nonstructural Alternatives; Ecologic Impact of Water Development.

07 RESOURCES DATA

Includes the following Groups: Network Design; Data Acquisition; Evaluation, Processing and Publication.

08 ENGINEERING WORKS

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SELECTED WATER RESOURCES ABSTRACTS

1. NATURE OF WATER

1A. Properties

THERMAL SPRINGS IN THE SALMON RIVER BASIN, CENTRAL IDAHO,
Geological Survey, Boise, ID. Water Resources Div.
H. W. Young, and R. E. Lewis.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: $6.25 in paper copy, $4.50 in microfiche. Geological Survey Open-File Report 82-104, February 1982. 27 p, 3 Fig, 2 Plates, 4 Tab, 17 Ref.

Descriptors: *Geothermal studies, *Thermal springs, *Chemical properties, *Physical properties, Water temperature, Chemical analysis, Stable isotopes, Radioisotopes, *Idaho, Salmon River basin, Idaho batholith.

The Salmon River basin drains approximately 13,000 square miles in central Idaho underlain by the Idaho batholith. Geologic units in the basin include igneous, sedimentary, and metamorphic rocks and granitic rocks predominate. Water from thermal springs ranges in temperature from 20.5 degrees to 94.0 degrees Celsius. The waters are slightly alkaline and are generally a sodium carbonate or bicarbonate type. Dissolved-solids concentrations are variable and range from 103 to 839 milligrams per liter. Estimated reservoir temperatures determined from the silicic acid-corrected silica, sodium-potassium-calcium, and sulfate-water isotope geothermometers range from 30 degrees to 184 degrees Celsius. Tritium concentrations in sampled thermal waters are near zero and indicate the waters are at least 100 years old and may be considerably older. Stable-isotope data indicate it is unlikely that a single area of recharge or a single hot-water reservoir supplies all hot springs in the basin. Thermal springs discharged at least 15,800 acre-feet of water in 1980. Associated convective heat flux is 27 million calories per second. (USGS)
W83-00552

2. WATER CYCLE

2A. General

GLACIAL-HYDROLOGICAL INVESTIGATIONS AT THE VERNAGTFERNER GLACIER AS A BASIS FOR A DISCHARGE MODEL,
Gesellschaft fuer Strahlenforschung m.b.H., Munich (Germany, F.R.). Inst. fuer Radiohydrometrie.
H. Oerter, D. Baker, H. Moser, and O. Reinwarth.
Nordic Hydrology, Vol 12, No 4/5, p 335-348, 1981. 8 Fig, 5 Tab, 11 Ref.

Descriptors: *Snowmelt, *Glaciers, Runoff volume, Mathematical models, Energy, Hydrographs, Alps, *Austria, *Vernagtfeoner glacier.

Data collected during glacial-hyd rological investigations at the Vernagtferner glacier in the Oetztal Alps, Austria, have been reviewed and utilized in the development of a deterministic discharge model. The gauge station 'Pegelstation Vernagtbach' has recorded the runoff from the glacier since 1974. The catchment area for the station is 11.44 square kilometers, with a mean altitude of 3,125 meters above sea level, and is 81% glaciated. Discharge hydrographs for the years 1974 through 1980 showed characteristic time intervals for the runoff and characteristic runoff components. The different discharge patterns exhibited by different parts of the glacier were used to develop spatial classification for the discharge formation and to describe the different hydraulic conditions. A mathematical model is proposed which uses four parallel linear reservoirs, which are characterized by linearity between water volume wi thin the reservoir and in the outflow, for which the storage constants had been previously determined. The model was used to calculate the runoff from the glacier for a 19-day period of dry and sunny weather using the energy balance on the glacier surface as the input data. The resultant calculated runoff was only slightly smaller than the runoff measured at the gauge station, demonstrating good agreement between calculated and measured data. (Carroll-FRC)
W83-00379

PROBABILITY OF ANNUAL FLOWS OF THE GREATER ZAB RIVER,
Clark (David) and Associates, Inc., Washington, DC.
For primary bibliographic entry see Field 2E.
W83-00457

A STORMWATER MANAGEMENT MODEL FOR THE WEST BRANCH BRANDYWINE CREEK, CHESTER COUNTY, PENNSYLVANIA,
Geological Survey, Harrisburg, PA. Water Resources Div.
For primary bibliographic entry see Field 4A.
W83-00562

A COMPUTER SIMULATION OF THE EFFECTS OF DIFFERING CROP TYPES ON THE WATER BALANCE OF SMALL CATCHMENTS OVER LONG TIME PERIODS,
Leeds Univ. (England). School of Geography.
For primary bibliographic entry see Field 2D.
W83-00585

THE IUH OF GENERAL HYDROLOGIC SYSTEM MODEL,
United Nations Educational, Scientific and Cultural Organization, Colombo (Sri Lanka).
V. F. Chow, and V. C. Kulandaiswamy.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 108, No HY7, p 830-844, July, 1982. 1 Tab, 6 Ref.

Descriptors: *Mathematical studies, *Unit hydrographs, *Hydrological models, *Systems analysis, *Rainfall, Differential equations, Boundary conditions, Hydrologic data, Model studies, Infiltration rate, Storage, Catchment basins, Storm runoff.

Two simple forms of the General Hydrologic system model (GHS) are described. Both a 5-parameter and a 3-parameter model are derived, and their instantaneous unit hydrographs (IUH) are compared. The GHS is a system of differential equations which describe continuity and storage in a given basin. For verification, the model was applied to 27 storm-runoff events that had occurred in six watersheds with different sizes. Results of the comparison between the 5-parameter and 3-parameter models suggest that the 5-parameter model is more realistic and fits the hydrologic data more consistently than the 3-parameter model. The advantage of the 3-parameter model is its simplicity; however, with computers to perform the computations, the 5-parameter model is superior overall. (Titus-FRC)
W83-00652

IMPROVEMENT OF NONLINEAR RAINFALL-RUNOFF MODEL,
California Univ., Davis. Dept. of Civil Engineering.
O. J. Helweg, J. Amorocho, and R. H. Finch.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 108, No HY7, p 813-822, July, 1982.

Descriptors: *Rainfall, *Mathematical models, *Rainfall-runoff relationships, Unit hydrographs, Systems analysis, Precipitation, Runoff, Watersheds, Hydrographs, Parametric hydrology, Synthetic hydrology, Model studies, Computer models, Hydrologic models, Nonlinear programming.

The Amorocho-Branstetter nonlinear rainfall-runoff model is discussed. It is an alternative to unit hydrograph models, which uses rainfall as the only input while runoff is the output. It is less popular than unit hydrographs because parameters must be determined by trial and error, requiring more mathematics. In this paper a method for efficiently calculating the three main model parameters is presented. Calculations of memory, order, and truncation can furthermore be programmed into the model to improve its efficiency. More work is needed to analyze the degree of nonlinearity of different watersheds to determine whether a nonlinear model is always better. (Titus-FRC)
W83-00654

DATA MANAGEMENT SYSTEM FOR URBAN HYDROLOGY STUDIES PROGRAM,
Geological Survey, NSTL Station, MS. Water Resources Div.
For primary bibliographic entry see Field 7C.
W83-00683

COMPUTER PROGRAMS FOR MODELING FLOW AND WATER QUALITY OF SURFACE WATER SYSTEMS,
Geological Survey, NSTL Station, MS. Water Resources Div.
J. A. Lorens.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: $4.25 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 82-430, 1982. 62 p, 2 Tab, 1 Ref.

Descriptors: *Hydrologic models, Watersheds, *Streamflow, *Surface waters, *Water quality, Computer programs, Model studies.

A selection of available computer programs for modeling flow and water quality in surface water systems is described. The models include programs developed as part of the U.S. Geological Survey Water Resources Division hydrologic research activities and others developed by other agencies, universities, and consulting firms. Each model description includes a statement of program use; data requirements; computer costs; availability of documentation and reference material; and a contact person for additional information. The report is intended to assist the researcher by presenting a very brief description of the surface-water models which are readily available for project use. (USGS)
W83-00687

2C. Snow, Ice, and Frost

ENVIRONMENTAL ISOTOPE STUDIES OF AN ALPINE SNOWPACK,
Gesellschaft fuer Strahlenforschung m.b.H., Munich (Germany, F.R.). Inst. fuer Radiohydrometrie.
W. Stichler, W. Rauert, and J. Martinec.
Nordic Hydrology, Vol 12, No 4/5, p 297-308, 1981. 7 Fig, 2 Tab, 14 Ref.

Descriptors: *Snowpack, *Isotope studies, Snow accumulation, Snowmelt, Lysimeters, Hydrologic budget, Evaporation, Alpine regions, Snow cover, *Switzerland, Weissfluhjoch.

Mass exchange processes during the buildup and ablation of the snow cover and the hydrologic balance were studied at an experimental plot at Weissfluhjoch in Switzerland, which has an elevation of 2,540 meters above sea level. The environmental isotopes tritium, deuterium, and oxygen-18 were measured in samples taken from the precipitation, the snow cover, and meltwater from a snow lysimeter during the period 1971 through 1979. Varying isotope concentrations were found in the respective snow layers, indicating a mass exchange between the percolating melt water and the snow pack which influences the isotope composition of the outflow from the snow lysimeter. A correlation was found between the isotope concentrations in the snow cover and in the melt water. The enrichment of melt water in heavy stable isotopes in comparison with the snow cover and precipitation can be used to calculate the evaporation independently from hydrologic measurements. The tritium data also suggest a strong mass exchange by evaporation and condensation at the snow surface. (Carroll-FRC)
W83-00360

ACCURACY OF SNOWMELT RUNOFF SIMULATION,
National Aeronautics and Space Administration, Greenbelt, MD. Goddard Space Flight Center.
A. Rango, and J. Martinec.
Nordic Hydrology, Vol 12, No 4/5, p 265-274, 1981. 4 Fig, 3 Tab, 7 Ref.

Descriptors: *Snowmelt, *Mountains, *Runoff, Simulation analysis, Snow cover, Temperature, Precipitation, Performance evaluation, Data acquisition, Mathematical studies.

A snowmelt runoff model described earlier uses air temperature, snow coverage, and precipitation during the snowmelt period as essential input data for simulation analysis. The results of runoff simulations obtained by applying the model to various basins were analyzed in an effort to predict the accuracy of simulations in future applications of the model. This analysis demonstrated that the model can be applied to nearly any mountainous basin where snowmelt runoff is an important factor if the essential input data are available. The accuracy of the simulation will depend on the quality of the temperature, precipitation, and snow cover data as well as on the density of observations, the size of the basin, the care in determining the recession coefficient, and the amount of precipitation during snowmelt. The most accurate simulations will result when temperature and precipitation are recorded at the basin mean elevation; weekly snow cover observations are available; several climatic stations are available for large basins; and a few years of runoff records are available for the determination of the recession coefficient. Decreases in accuracy can be expected as these optimum conditions are compromised. However, even when climatological observations are not possible at multiple stations and when the recession coefficient must be estimated on the basis of a comparison of basin size with previously analyzed basins, acceptable simulations will result if temperature and precipitation data are available in the general vicinity of the basin and if snow cover observations are available two or three times during the snowmelt season. The availability of satellite observations of snow cover has enabled successful application of the simulation model to large basins. (Carroll-FRC)
W83-00370

ISOTOPE INPUT INTO RUNOFF SYSTEMS FROM MELTING SNOW COVERS,
Technische Univ., Brunswick (Germany, F.R.). Lehrstuhl fuer Physische, Geographie und Landschaftsokologie.
A. Herrmann, M. Lehrer, and W. Stichler.
Nordic Hydrology, Vol 12, No 4/5, p 309-318, 1981. 10 Fig, 8 Ref.

Descriptors: *Isotope studies, *Snowmelt, Runoff, Hydrographs, Hydrologic budget, Snow cover, Melting, *West Germany, Lainbach Creek basin.

The stable environmental isotopes deuterium and oxygen-18 are ideal tracers in the hydrologic cycle, suppling effective insight into basin runoff mechanisms and storage dynamics. Isotope techniques using these isotopes contribute to reasonable separations of the direct runoff component in snowmelt hydrographs. However, the real or actual isotope input values from the snow cover outflows are required for the separation procedure. Several cold room experiments with isotopically homogenous and stratified snow columns were conducted to study the effects of isotope fractionation and exchange processes in the snow cover on the isotopic outflow concentrations. The columns were treated with different heat supply and rainwater at the surface to simulate natural conditions. Outflows were analyzed for deuterium and oxygen-18 contents. Alterations of the melt intensities caused marked variations of the isotope contents of snowpack outflows. The difference between the deuterium contents of the surface layer, where the initial melt water is produced, and that of the outflows was very small. Hydrologic applications of the results to studies in the natural environment are discussed. (Carroll-FRC)
W83-00374

EFFECT OF SCALE ON THE COMPLEXITY OF SNOWMELT SYSTEMS,
Eidgenoessische Technische Hochschule, Zurich (Switzerland). Lab. of Hy draulics Hydrology and Glaciology.
L. N. Braun, and H. O. Slaymaker.
Nordic Hydrology, Vol 12, No 4/5, p 225-234, 1981. 8 Fig, 1 Tab, 11 Ref.

Descriptors: *Snowmelt, *Hydrologic budget, *Streamflow forecasting, Measurement techniques, Glaciers, Alpine regions, Watersheds, Prediction, Forecasting, *British Columbia, Miller Creek.

The value of using several spatial scales in the investigation of the interaction of atmospheric and hydrologic systems involved in snowmelt processes was evaluated. Studies of the nature of snow and ice storage, energy sources, and stream flow response were conducted during the melt season of 1978 at both a small scale watershed and a meso-scale watershed in the Pacific Coast Mountains of British Columbia, Canada. The release of meltwater at the base of the snowpack at the site scale was found to be a function of snow depth and density and of the timing of peak energy availability. At the small watershed scale, streamflow was primarily a function of snow phenology and variable runoff generation pathways. Streamflow at the meso-watershed scale was shown to be influenced primarily by snow and ice phenology, by the progressive development of englacial drainage systems, by the integrated response of individual tributaries draining slopes of varying aspects, and by lake and channel storage mechanisms. Different methods of analysis of snowmelt systems were also appropriate at the different scales. (Carroll-FRC)
W83-00375

MEASURING AND MODELLING SNOWMELT IN DYRDALEN, WESTERN NORWAY, 1979 AND 1980,
Bergen Univ. (Norway). Geofisisk Inst.
K. Harstveit.
Nordic Hydrology, Vol 12, No 4/5, p 235-246, 1981. 7 Fig, 5 Tab, 5 Ref.

Descriptors: *Snowmelt, *Measuring instruments, *Hydrologic budget, Energy, Mathematical models, Melting, Model studies, Prediction, Forecasting, *Norway, Dyrdalen.

Better models for predicting snowmelt are needed for use in such fields as hydroelectric power production and flood forecasting. A lysimeter was used to measure the runoff from a 9 square meter snowpack during the spring snowmelts in 1979 and 1980. Measurements of wind speed, air temperature, air humidity, radiation, and precipitation were also recorded. The melting rate and the net radiation values were used to compute the turbulent heat exchange between the snowpack and the atmosphere as a residual from the energy balance equation of the snowpack. These computed values were then used to find 'optimal' empirical constants in aerodynamic equations expressing the turbulent fluxes as functions of the wind speed and the temperature/vapor pressure differences between measurements 2 meters above the ground (0.6 to 1.5 meters above the snow surface) and the values at the surface. There was reasonable agreement between these values and the constants found by other researchers. The sensible heat flux represented 65% of the total energy consumed in melting during the two melting seasons, while net radiation represented 35%. Condensation and evaporation accounted for 13% of the energy lost and gained, respectively. Individual fluxes accounted for varying contributions to the melting from one day to another. The energy balance model yielded better results than the degree-day-model when weather conditions varied during the melting season. The simple degree-day-method gave good results only when there was no considerable variation in meteorological conditions during snowmelt. Snowmelt was about three times greater on overcast days than on days with light cloudiness, providing the wind and temperature conditions were the same and the albedo was about 70%. (Carroll-FRC)
W83-00376

MELTWATER HYDROLOGY AND HYDROCHEMISTRY IN SNOW- AND ICE-COVERED MOUNTAIN CATCHMENTS,
Victoria Univ. of Manchester (England). Dept. of Geography.
D. N. Collins, and G. J. Young.
Nordic Hydrology, Vol 12, No 4/5, p 319-334, 1981. 6 Fig, 2 Tab, 23 Ref.

Descriptors: *Snowmelt, *Conductivity, *Chemical composition, Dissolved solids, Watersheds, Alpine regions, Mountains, Glaciers, Water quality, Hydrology, Canada, Rocky Mountains, *Alberta, *British Columbia, Peyto Creek basin, Mistaya River basin.

Basic hydrological and hydrochemical data from two adjacent but contrasting alpine watersheds were compared in an effort to identify any distinctive features of snow- and ice-melt runoff patterns and to investigate the role of glacierization in alpine hydrochemistry. Electrical conductivity, a surrogate measure of total dissolved solids content, and meltwater discharges were recorded continuously in the two watersheds from mid-May through August, 1979. Solute concentration was found to vary inversely diurnally with discharge in both nival (seasonally snow-covered, but ice free) and glacial meltwaters. The snowmelt-fed Amiskwi River experienced a decline in solute content and discharge with decreasing availability of snow cover through July, followed by increased solute content during the low flows of August. Peyto Creek, which receives meltwater from a glacier, experienced decreased conductivity with increasing flow during the spring snow melt. H owever, conductivity oscillated daily through a limited range during the ice-melt domination of the flow from mid-July through August. These results demonstrated the contrasting roles of snowmelt and ice-melt in determining distinctive patterns of diurnal and seasonal temporal variations of discharge and hydrochemistry in mountain basins. Continuous monitoring of water quality is essential in characterizing the hydrochemistry of alpine environments. (Carroll-FRC)
W83-00377

APPLICATION OF THE GRAVITY FLOW THEORY TO THE PERCOLATION OF MELT WATER THROUGH FIRN,
Innsbruck Univ. (Austria). Inst. for Physical Medicine.
W. Ambach, M. Blumthaler, and P. Kirchlechner.
Journal of Glaciology, Vol 27, No 95, p 67-75, 1981. 5 Fig, 1 Tab, 14 Ref.

Descriptors: *Firn, *Snowmelt, *Percolation, *Gravity flow theory, Old snow, Glaciohydrology, Drainage, Snow, Glaciers.

The gravity flow theory was applied to the percolation of meltwater through the firn in the accumulation area of a temperate glacier to explain the occurrence of shock fronts in the meltwater flow. Since percolation velocity of meltwater increases with increasing flux, later, larger fluxes may catch up with smaller, earlier fluxes, forming a sudden increase in meltwater flux, known as a shock front. The time of propagation of a shock front moving from the surface through the firn was calculated. For example, for a firn 24 m deep and 2 peaks of meltwater input 12 hours apart, shock fronts were calculated at 77 and 101 hours at 24 m depth. Different time input functions of meltwater flux at the surface with constant total input volumes produced slight differences in terms of propagation of the shock front at greater depths. A nearly linear relationship was found between the time of propagation of a shock front moving through the firn and the total thickness of the firn. The drainage of meltwater from the firn after the summer ablation period was also described by the gravity flow theory. Observed lags in time between maximum meltwater inflow at the surface and the maximum flow at 24 m depth in the firn (50-100 hours) agreed well with calculated results. (Cassar-FRC)
W83-00513

FROZEN SOIL EFFECTS ON THE EROSION HAZARD,

Idaho Univ., Moscow. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 2J.
W83-00615

2D. Evaporation and Transpiration

EVAPOTRANSPIRATION AT TWO MOUNTAIN SITES DURING THE VEGETATION PERIOD,
Innsbruck Univ. (Austria). Inst. for Meteorology and Geophysics.
M. Staudinger, and H. Rott.
Nordic Hydrology, Vol 12, No 4/5, p 207-216, 1981. 4 Fig, 3 Tab, 4 Ref.

Descriptors: *Evapotranspiration, *Alpine regions, *Mountains, Energy, Precipitation, Solar radiation, Soil water, Vegetation, Diurnal variation, Radiation, *Austrian Alps.

The components of the surface energy balance and other meteorological parameters were measured at two test sites in the Austrian Alps in the months of July, August, and September of the years 1976 to 1978 and were used to calculate hourly, daily, and monthly evapotranspiration. One of the test sites was located at 1,960 meters above sea level, on a cultivated meadow slightly below the timberline, while the other was situated at 2,580 meters above sea level and was covered with alpine sedges and grasses. The calculated evapotranspiration values clearly demonstrate the decrease of evapotranspiration with altitude. Evapotranspiration was about 30% lower at the higher elevation for the vegetation periods considered, reflecting both the decrease of transpiring leaf areas and the increasing percentage of evaporation from soil with higher altitude. At the lower site, the amount of evaporation sometimes reached the order of total precipitation during the vegetation period. Net solar radiation was found to be the primary limiting factor for evapotranspiration at these Alpine sites. Diurnal variations of evapotranspiration followed the course of net radiation, indicating sufficient moisture supply. Plant transpiration diminished towards the end of the vegetation period, increasing the variability of the relation between net radiation and evapotranspiration to some degree and indicating some influence of precipitation on the amount of evapotranspiration. The high correlations found between the daily sums of net radiation and of evapotranspiration at both sites can be used for calculating evapotranspiration from radiation measurements. (Carroll-FRC)
W83-00352

IS EVAPORATION AN IMPORTANT COMPONENT IN HIGH ALPINE HYDROLOGY.
Eidgenoessische Technische Hochschule, Zurich (Switzerland).
H. Lang.
Nordic Hydrology, Vol 12, No 4/5, p 217-224, 1981. 3 Fig, 2 Tab, 15 Ref.

Descriptors: *Evaporation, *Alpine regions, *Hydrologic budget, Hydrology, Precipitation, Condensation, Glaciers, Snow cover, Ice cover, *Alps, Europe.

Evaporation in the high mountain areas of the European Alps is poorly understood. Current evaluations indicate that evaporation is a component of secondary importance in the water balance in these areas. The available mean areal evaporation data are based on conventional water balance estimates and suffer from inaccuracies in the determination of precipitation. Re searchers have reported rates of decrease in mean annual evaporation with altitude ranging from 71 millimeters t o 356 millimeters per 1,000 meters of altitide. Heat balance studies on glaciers demonstrate that evaporation/condensation is a process of high specific energy exchange, with the scale width of the latent heat flux of glaciers matching that of net radiation and being more than double the value of the sensible heat flux. Evaporation and condensation processes are important controlling factors in the time scale of the daily variations of the water balance in snow and ice areas under the existing climatic conditions in the Alps. (Carroll-FRC)
W83-00373

A COMPUTER SIMULATION OF THE EFFECTS OF DIFFERING CROP TYPES ON THE WATER BALANCE OF SMALL CATCHMENTS OVER LONG TIME PERIODS,
Leeds Univ. (England). School of Geography.
P. J. Sellers, and J. G. Lockwood.
Quarterly Journal of the Royal Meteorological Society, Vol 107, No 452, p 395-414, April, 1981. 14 Fig, 25 Ref.

Descriptors: *Interception loss, *Forest hydrology, *Hydrologic budget, Model studies, Pine trees, Grasslands, Hydrologic models, Runoff, Soil-water-plant relationships, Simulation analysis, Evaporation, Rainfall-runoff relationships, Transpiration, Trees.

A multilayer model (MANTA), suitable for tall crops, is used to simulate interception and evaporation of rainfall and transpiration loss for a pine forest. The most important improvement over the Rutter (1971) single layer model is the inclusion of a wetted area term, which allows more realistic modeling of the leaf's energy balance. However, the multilayer model has demanding data requirements. To overcome these difficulties, three submodels (standard meteorological site model, hydrological model, and multilayer model) are run together. Results of model runs suggest that the Rutter model substantially underestimates interception loss from low intensity rainstorms. Using a year's simulated meteorological data MANTA predicts an interception loss 20% greater than the Rutter estimate. Similarly, the interception losses predicted for pine forests are 4 times greater than for grassland. Predicted peak flows in grassland were 30% higher than in pine forests; total runoff in grasslands was twice as high as in pine. The MANTA results agree generally with experimental observations of other researchers on heat and vapor fluxes above wet and dry coniferous canopies. The effects of plant geometry on rate of interception loss are evident. (Cassar-FRC)
W83-00585

EVAPOTRANSPIRATION FROM RIPARIAN VEGETATION: WATER RELATIONS AND IRRECOVERABLE LOSSES FOR SALTCEDAR,
California Univ., Davis. Dept. of Land, Air and Water Resources.
For primary bibliographic entry see Field 3B.
W83-00663

EVAPOTRANSPIRATION FROM RIPARIAN VEGETATION: CONSERVING WATER BY REDUCING SALTCEDAR TRANSPIRATION,
California Univ., Davis. Dept. of Land, Air and Water Resources.
For primary bibliographic entry see Field 3B.
W83-00664

2E. Streamflow and Runoff

PROBABILITY OF ANNUAL FLOWS OF THE GREATER ZAB RIVER,
Clark (David) and Associates, Inc., Washington, DC.
F. El-Yussif.
Water Supply and Management, Vol 6, No 4, p 297-302, 1982. 9 Ref.

Descriptors: *River flow, *Flow characteristics, *Correlation analysis, Rainfall-runoff relationships, Greater Zab River, *Iraq, Runoff, Probabilistic process, Stochastic hydrology.

Annual flows for the Greater Zab River, Iraq, measured at one river station and 2 tributary stations, were analyzed for the years 1938-77. At Eski-kelek the average annual flow for this 40-year period was 13.461 cu km; minimum flow (1955), 8.672 cu km; and maximum flow (1969) 23.684 cu km. The flow series was stable according to analysis by the moving average technique. A cycle with a 15 year period was indicated. Rainfall-runoff relationships, studied with the lag cross correlation technique, showed that no significant cross correlation existed. (Cassar-FRC)
W83-00457

FLOW BENEATH A STAGNANT FILM ON WATER: THE REYNOLDS RIDGE,
Essex Univ., Colchester (England). Fluid Mechanics Research Inst.
For primary bibliographic entry see Field 8B.
W83-00516

LOW-FLOW CHARACTERISTICS OF OHIO STREAMS,
Geological Survey, Columbus, OH. Water Resources Div.
For primary bibliographic entry see Field 7C.
W83-00563

A RAPID, LOW-COST TECHNIQUE FOR ESTIMATING PEAK FLOW FOR SELECTED FLOOD EVENTS,
North Carolina Univ., Charlotte, Dept. of Geography and Earth Sciences.
N. R. Nunnally.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-125179, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Research Institute Report No 180, North Carolina State University, Raleigh, May 1982. 31 p, 9 Fig, 3 Tab, 36 Ref, 1 Append. OWRT A-119-NC(1), 14-34-0001-1135.

Descriptors: *Streamflow forecasting, *Flood peak, *Flood flow, *Mathematical equations, *Urban watersheds, Economic aspects, Peak loads, Flood forecasting, Flood crest, Maximum probable floods, *North Carolina, Virginia, Flood profiles, Multivariate analysis, Urban hydrology, Mathematical models, Model studies, Long-term planning.

A regionalized streamflow estimation technique was developed for North Carolina and Virginia for estimating 2-, 10-, and 25-year return interval peak flows. Separate equations were generated for the mountain, piedmont, and coastal plain regions, and for urbanized watersheds. Comparison with previous techniques used in North Carolina indicated that the new equations produce more accurate peak discharge estimates in most instances. The technique was based on improved regression equations, obtained by confining the study to small watersheds, expanding the sample size (by using stream basins outside North Carolina), using longer data records and more variables which influence peak discharge, and controlling some of the data variance (by creating more homogeneous regions through the use of multivariate techniques). If return intervals, basin size, and lag are held constant, urban basins produce the largest discharge (followed by mountain, piedmont, and coastal plain). Equations developed for urban basins were the most accurate, overall. Peak discharge estimates for rural basins were improved, but U.S.G.S. equations gave slightly better results in some cases. (Zielinksi-MAXIMA)
W83-00613

INFILTRATION FORMULAS BY CURVE NUMBER PROCEDURE,
Geological Survey, NSTL Station, MS. Gulf Coast Hydroscience Center.
C.-L. Chen.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 108, No HY7, p 823-829, July, 1982. 1 Fig, 6 Ref.

Descriptors: *Infiltration, *Hydrologic budget, *Runoff, *Rainfall, *Mathematical studies, Infiltration rate, Watersheds, Algorithms, Depression storage, Interception, Precipitation, Hydrologic models, Rainfall intensity, Depth-area-duration analysis.

The Soil Conservation Service curve number procedure for estimating runoff volume is examined in terms of the validity and applicability of the de-

rived infiltration equations. The infiltration rate formula derived based on the hypothesis that potential maximum retention or infiltration includes the initial abstraction proves to be as general as, if not more general than, the Holtan-Overton equation. If the initial abstraction results mainly from infiltration that occurs before runoff begins, the amount of initial abstraction can be reasonably estimated from the derived infiltration rate formula, and the curve number procedure can be generalized without sacrificing its simplicity. The proposed method may not be valid for large watersheds where surface interception and depression storage dominate the initial abstraction. (Titus-FRC)
W83-00653

FLOOD DATA IN WEST WINDSOR TOWNSHIP, MERCER COUNTY, NEW JERSEY THROUGH 1981 WATER YEAR,
Geological Survey, Trenton, NJ. Water Resources Div.
For primary bibliographic entry see Field 7C.
W83-00690

ACOUSTIC SYSTEMS FOR THE MEASUREMENT OF STREAMFLOW,
Geological Survey, Portland, OR. Water Resources Div.
For primary bibliographic entry see Field 7B.
W83-00692

BACKGROUND HYDROLOGIC INFORMATION IN POTENTIAL LIGNITE MINING AREAS IN MISSISSIPPI, AUGUST 1981,
Geological Survey, Jackson, MS. Water Resources Div.
For primary bibliographic entry see Field 7C.
W83-00693

2F. Groundwater

PREDICTING DEPTHS TO THE WATER TABLE IN DEEPLY WEATHERED RIVER CATCHMENTS IN NIGERIA,
Ife Univ. (Nigeria). Dept. of Geography.
E. O. Omorinbola.
Journal of the Institution of Water Engineers and Scientists, Vol 36, No 3, p 191-204, May, 1982. 8 Fig, 8 Tab, 21 Ref.

Descriptors: *Prediction, *Water table profiles, *Groundwater level, *Nigeria, Catchments, Tropical regions, Observation wells, River basins, Spatial distribution, Temporal distribution, Regression analysis, Middle Osun Valley, Upper Oba Basin, Middle Owena Valley, Wells.

Depth to water table was studied in 3 major Nigerian river catchments, Middle Osun Valley, Upper Oba Basin, and Middle Owena Valley. The basins are Pre-Cambrian igneous and metamorphic rocks, chemically weathered by the tropical climate to average depths of 13-29 m. The main rivers have year-round flows and the tributaries, seasonal flows. Springs are rare. Mean annual rainfalls are 1480-1700 mm. Correlation coefficients were 0.92-0.96 for the 2 methods used to determine depth to water table: seismic refraction and observations of well water levels. Spatial and temporal variations of the water table level were determined from equations. In general, depths to the water table gradually increase to 10 m with distance from the river channel and can be predicted in advance of drilling. The maximum and minimum depths (3-4 m difference) to the water surface occur in February and July, respectively, for Osun and Oba, and January and July, respectively, for Owena. These findings can apply to similar catchments of the Basement Complex where the same environmental conditions prevail, such as areas of low-relief landscape, channels incised to bedrock, and regoliths with thick, widespread zones of saturation. (Cassar-FRC)
W83-00497

JANUARY 1981 WATER LEVELS, AND DATA RELATED TO WATER-LEVEL CHANGES, WESTERN AND SOUTH-CENTRAL KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
For primary bibliographic entry see Field 7C.
W83-00553

HYDROLOGY AND CHEMICAL QUALITY OF GROUND WATER IN KIOWA COUNTY, COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 7C.
W83-00561

DEEP OXYGENATED GROUND WATER: ANOMALY OR COMMON OCCURRENCE.,
Geological Survey, Reston, VA.
I. J. Winograd, and F. N. Robertson.
Science, Vol 216, No 4551, p 1227-1230, June 11, 1982. 2 Fig, 17 Ref.

Descriptors: *Groundwater, *Dissolved oxygen, *Aquifers, Groundwater dating, Recharge, Natural recharge, Groundwater recharge, Oxidation, Confined aquifers, Water properties, Chemical properties, Arid climates, Humid climates, *Nevada, *Arizona, *Arkansas, Hot springs, Appalachians.

The widespread presence of dissolved oxygen (DO) in significant concentrations (2-8 mg/l) is documented in water several thousand to > 10,000 years old from deep aquifers of several lithologies in arid and humid climates and at distances as great as 80 km from recharge areas. This evidence is contrary to the prevailing opinion that most DO in recharge water is consumed in the soil and unsaturated (or vadose) zones by the decomposition of organic matter and by microbial respi ration. Concentrations of 2-8 mg/l of DO were found in several aquifers in the south-central Great Basin, Nevada, where water table depths range from 200 to 1,000 m below the surface, the residence time of water is thousands to > 10,000 years, and at least one flow path is 80 km long. In the southern Arizona portion of the Basin and Range province, DO has been discovered in all shallow (< 100 m) and deep water from valley-fill aquifers. In many of these areas a clay stratum of > 100 m overlies the aquifer, preventing the mixing of deep water with shallow oxygenated groundwater. This water was estimated to be > 10,000 years old by C14 dating. Thermal spring waters in the Valley and Ridge Province from Georgia to New York and water in Hot Springs National Park, Arkansas have DO contents of 2-7 mg/1. Water temperatures are 30-60C, and flow paths from recharge to discharge areas are relatively short. H-3 data suggest that though the DO content of some of the hot springs may be a result of the mixing of deep thermal waters and shallow, cooler, younger ground water, several springs are of predominantly pre-H-bomb (1952) age. The presence of DO in the waters of Nevada and Arizona may be explained by the fact that valley-fill sediments were deposited under oxidizing conditions and probably remained exposed to oxidizing climates for tens to hundreds of years before burial; they then remained in oxidizing unsaturated zones for tens of thousands to hundreds of thousands of years. (Gish-FRC)
W83-00565

A CONDUCTIOMETRIC TECHNIQUE FOR MEASURING THE WATER VELOCITY IN SALMONID SPAWNING BEDS,
University of Wales Inst. of Science and Technology, Cardiff (England). Dept. of Applied Biology.
A. W. H. Turnpenny, and R. Williams.
Water Research, Vol 16, No 9, p 1383-1390, September, 1982. 7 Fig, 2 Tab, 12 Ref.

Descriptors: *Groundwater movement, Velocity, *Streambeds, *Standpipes, Remote sensing, Sampling, *Salmonids, Permeability, Gravel, *Spawning, *Conductiometric techniques, Fish, Measuring instruments, Fish eggs.

A modified standpipe technique has been developed to measure the groundwater velocity (also known as gravel permeability or apparent velocity) in salmonid spawning beds. This parameter is important because eggs of intragravel spawners and benthic invertebrates receive their oxygen supply from groundwater permeating through the gravel beds. An electrolyte, composed of 546 ml of 20 g per liter NaCl solution and 454 ml of pure ethanol, is placed in the standpipe. This arrangement allows conductivity changes and dilution rates to be determined by remote sensing. Since up to 8 standpipes may be operated in a spawning bed, systematic or randomized grid sampling designs may be used. Coefficients of variation were less than 8% for gravel permeabilities of 420-79,200 cm per hour and an average of 5% for apparent velocities of 11-239 cm per hour. (Cassar-FRC)
W83-00644

AVAILABILITY OF WATER FROM AQUIFERS IN UPSTATE NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
For primary bibliographic entry see Field 7C.
W83-00681

HYDROLOGIC DATA FROM TEST WELLS AND LOW-FLOW INVESTIGATIONS IN THE MIDDLE REACH OF THE EAGLE RIVER VALLEY, ALASKA, 1980-81,
Geological Survey, Anchorage, AK. Water Resources Div.
For primary bibliographic entry see Field 7C.
W83-00682

GROUND-WATER LEVELS IN SELECTED WELL FIELDS AND IN WEST-CENTRAL FLORIDA, SEPTEMBER 1981,
Geological Survey, Tampa, FL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W83-00685

AQUIFER DATA FROM FOUR WELLS IN THE MENDENHALL VALLEY NEAR JUNEAU, ALASKA,
Geological Survey, Anchorage, AK. Water Resources Div.
For primary bibliographic entry see Field 7C.
W83-00686

REGIONAL GEOHYDROLOGY OF THE NORTHERN LOUISIAN SALT-DOME BASIN, PART I, CONCEPTUAL MODEL AND DATA NEEDS,
Geological Survey, Baton Rouge, LA. Water Resources Div.
G. N. Ryals.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: $4.00 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 82-343, 1982. 23 p, 5 Fig, 2 Plates, 6 Tab, 25 Ref.

Descriptors: *Underground waste disposal, *Geohydrology, *Groundwater movement, *Path of pollutants, Model studies, Aquifer characteristics, Water quality, Surface-groundwater relationships, Radioactive waste disposal, Waste management, Water analysis, Potentiometric level, Radioactive analysis, *Louisana, Northern Louisana salt-dome basin.

As part of the National Waste Terminal Storage Program, the U.S. Geological Survey is conducting a regional study of the geohydrology of the northern Louisiana salt-dome basin and developing a regional multi-layered ground-water flow model to determine regional flow paths. In the salt-dome basin the Tokio Formation and Brownstown Marl (Austin aquifer in this report), and Nacatoch Sand of Late Cretaceous age and the Wilcox Group, Carrizo Sand, Sparta Sand, and Cockfield Formation of Tertiary age contain regional aquifers within the maximum potential repository depth of 3,000 feet. The Cretaceous units contain saltwater throughout the basin. The Tertiary units contain freshwater to varying distances downdip from outcrop areas in the basin. Natural flow directions and

rates of movement of groundwater have been changed in the salt-dome basin by the withdrawl of freshwater and by the injection of wastes (principally oil-field brines) into saline aquifers. Except for the Sparta aquifer, ground-water flow directions are not well known because of a lack of potentiometric data. A regional test-drilling program, to collect the data needed to document concepts of the flow system and to quantify inputs to the planned ground-water flow model, has been proposed. The Sparta aquifer is being modeled because data are available for the unit. As regional test drilling provides data on other units, will be added to the model developed for the Sparta aquifer. (USGS)
W83-00691

GROUND-WATER QUALITY IN EAST-CENTRAL IDAHO VALLEYS,
Geological Survey, Boise, ID. Water Resources Div.
For primary bibliographic entry see Field 7C.
W83-00694

GEOHYDROLOGY OF THE VALLEY-FILL AQUIFER IN THE CORTLAND-HOMER-PREBLE AREA, CORTLAND AND ONONDAGA COUNTIES, NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
For primary bibliographic entry see Field 7C.
W83-00697

GEOHYDROLOGY OF THE VALLEY-FILL AQUIFER IN THE SPROUT AND FISHKILL CREEKS AREA, DUTCHESS COUNTY, NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
For primary bibliographic entry see Field 7C.
W83-00698

GEOHYDROLOGY OF THE GLACIOLACUSTRINE AQUIFER IN THE FULTON AREA, OSWEGO COUNTY, NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
For primary bibliographic entry see Field 7C.
W83-00699

2G. Water In Soils

EMPIRICAL RELATIONS BETWEEN SOIL COMPONENTS AND WATER RETENTION AT 1/3 AND 15 ATMOSPHERES,
Department of Agriculture, Ottawa (Ontario). Land Resource Research Inst.
R. De Jong, and K. Loebel.
Canadian Journal of Soil Science, Vol 62, No 2, p 343-350, May, 1982. 5 Tab, 30 Ref.

Descriptors: *Soil properties, *Water management, Resources management, Moisture availability, Moisture profiles, Information systems, Data collections, Model studies.

Information available from Canada Soil Information System (CanSIS) for soil-water-modeling purposes was used in developing regression equations which relate physical and chemical soil components to water retention. Such equations can be used either to estimate soil-water-holding capacity or to model soil water characteristic curves, required by budget and physical models, respectively. Multiple linear regression procedures were used to relate particle size distribution, percent silt, and organic carbon content to the gravimetric soil water content at 1/3 atmosphere and 15 atmosphere tensions, determined on disturbed samples. Some of the discrepancies encountered between predicted and observed values could be attributed to the mineralogical and/or textural distribution of the prediction vs. test data, but in other cases causes of inconsistency were unclear. The equations which were not tested due to insufficient available test data should be used with caution. (Baker-FRC)
W83-00415

2H. Lakes

BIOLOGY, METABOLISM AND FUNCTIONS OF LITTORAL SUBMERSED WEEDBEDS OF LAKE WINGRA, WISCONSIN, USA: A SUMMARY AND REVIEW,
Wisconsin Univ.-Madison. Dept. of Botany.
M. S. Adams, and R. T. Prentki.
Archiv fur Hydrobiologie Supplement, Vol 62, No 3/4, p 333-409, April, 1982. 15 Fig, 3 Tab, 119 Ref.

Descriptors: *Nutrients, *Aquatic plants, *Sediments, Lakes, Macrophytes, *Littoral zone, *Lake Wingra, *Wisconsin, Phytoplankton, Algae, Eutrophic lakes, Phosphorus, Nitrogen, Biomass, Seasonal variation, Productivity, Photosynthesis, Anaerobic conditions, Methane, Organic carbon, Population dynamics, Cycling nutrients.

Over 10 years of investigations of the macrophyte biology, metabolism, and function of the littoral zone of the 137 ha scenescent, eutrophic Lake Wingra, Wisconsin are summarized. Research concentrated on (1) productivity and biomass of submerged weedbeds, (2) physiological ecology of important species, (3) macrophytenutrient interactions, and (4) the role of littoral weedbeds in processing and exporting organic matter and nutrients. Myriophyllum spicatum became dominant in 1966 and declined rapidly by 1977. Competition between M. spicatum and the native Vallisneria americana indicated that Vallisneria is a summer specialist, adversely affected by decreased water transparency. M. spicatum forms dense canopies and stores carbohydrates in roots, permitting overwintering and early spring growth. Epiphyton were predominantly diatoms and other non-matforming algae, with the exception of Oedogonium, which formed dense mats near storm sewer outfalls. Macrophyte decomposition rate was high, producing large amounts of dissolved organic matter and nutrients. Anaerobic decomposition produced 700,000 moles of methane, 92% coming from the weedbed sediments. M. spicatum obtained 73% of tissue P from sediments by root uptake, mostly in fall. At times, the P level was lower than the critical concentration affecting photosynthesis rates. On decomposition of the plant, P was sloughed off or leached. Net transport of BOD, dissolved inorganic and organic P, dissolved organic carbon, and dissolved organic nitrogen was always from the littoral zone to the pelagic zone. The exported nutrients were largely derived from the macrophyte autolysis and decay. In this lake primary production was 430 g C per sq m per year (70%) from phytoplankton and 182 g C per sq m per year (30%) from macrophyte-epiphyton. Storm water runoff generally moved directly to the pelagic zone. (Cassar-FRC)
W83-00351

PHYSICAL AND CHEMICAL FEATURES OF PLAYA LAKES IN SOUTHEASTERN CALIFORNIA, USA,
Arizona State Univ., Tempe. Dept. of Zoology.
D. M. Kubly.
Archiv fur Hydrobiologie, Supplement, Vol 62, No 3/4, p 491-525, April, 1982. 3 Fig, 6 Tab, 79 Ref.

Descriptors: *Playas, *Saline lakes, *Geochemistry, Semiarid lands, Arid lands, Closed lakes, Lakes, Salinity, Chemical composition, Turbidity, Organic matter, Anions, Cations, Ephemeral lakes, Shallow water, Dry lakes, *California, Deserts, Phosphorus, Evaporation, Crystallization, Bicarbonates, Carbonates, Calcium, Magnesium, Sodium, Chlorides, Sulfates, Water quality.

Playas, or dry lakes, in southeast California were studied during 3 field trips in the winter and spring of 1978 and spring of 1979. Climate is hot and dry with temperatures up to 56C, highly variable precipitation, and low relative humidity. Characteristic of the 40 lakes surveyed were -80m to 1600m altitude, 2.3 to 29,020 ha (most smaller than 1000 ha) area, 100 to 325,000 ppm salinity, 96 to 338,064 ppm total dissolved solids, 5.8 to 13.8 ppm dissolved oxygen, 5 to 21,050 JTU turbidity, 7.5 to 10.0 pH, 0.11 to 73.31 ppm phosphate, and 3.4 to 534.6 ppm Si02. Most lakes were elliptical and contained shallow, well-mixed waters overlying level bottoms. Ratios of water volume to sediment area were extremely low. Thermal stratification and oxygen depletion were not observed. Na was the dominant cation in all but 1 lake. Its dominance was attributed to fractional dissolution of efflorescent salts and cation excha nge on clay minerals, rather than evaporation-crystallization. Low salinity lakes generally contained sodium car bonate-bicarbonate water. As total dissolved solids increased, Cl and sulfate concentrations increased. Some waters were nearly pure chloride brines. Principal component analysis showed a transition from very turbid, dilute lakes with high organic matter to lo w turbidity, higher saline lakes with low organic matter. Principal component analysis also divided the 7 most saline lakes into 2 groups: (1) high pH, total alkalinity, silica, and total P, with much of the Ca and Mg already precipitated and (2) lower pH, total alkalinity, silica, total P, with an excess of dissolved Ca and Mg over carbonate/bicarbonate. These groupings were a result of the differences in bicarbonate/Ca + Mg mole ratios of inflowing waters, which determined different evaporation-crystallization pathways. (Cassar-FRC)
W83-00372

ASSESSING BIOMASS AND PRODUCTION OF BACTERIA IN EUTROPHIC LAKE MENDOTA, WISCONSIN,
Wisconsin Univ.-Madison. Dept. of Bacteriology.
C. Pedros-Alio, and T. D. Brock.
Applied and Environmental Microbiology, Vol 44, No 1, p 203-218, July, 1982. 10 Fig, 4 Tab, 53 Ref.

Descriptors: *Eutrophic lakes, *Bacteria, Sedimentation, *Lake sediments, Sediments, Zooplankton, Productivity, Biomass, *Wisconsin, *Lake Mendota, *Eutrophication, Primary productivity.

Estimates were made of bacterial biomass and production in a eutrophic lake using recently developed techniques. Cell counts in the epilimnion of Lake Mendota, Wisconsin were done with epifluorescence microscopy and varied from 300,000 bacteria per ml in winter to 3,000,000 bacteria ml in summer. Cell volumes were measured using scanning electron micographs. Annual variations and depth distribution were studied. Production was estimated from the frequency of dividing cells and from dark radioactive sulfate uptake. Annual productivity and daily average productivity were very close with both methods: 107 to 205 g of C square m per year for sulfate and 89 to 117 g of C per square m per year for frequency of dividing cells. Zooplankton feeding removed 2 to 10% of the bacterial net production annually. When compared with biomass changes and losses due to zooplankton feeding, production values were very high. Thus it was concluded that other loss factors have to be more important than zooplankton feeding in controlling the bacterial population. Bacterial heterotrophic production was about 50% of gross primary production. It is suggested that a considerable proportion of the bacterial production is locked into particles and sediments with them to the hypolimnion and eventually to the bottom of the lake. (Baker-FRC)
W83-00384

PRIMARY PRODUCTIVITY AND NUTRIENT BALANCE IN A LOWER COLORADO RIVER RESERVOIR,
Department of Scientific and Industrial Research, Taupo (New Zealand). Freshwater Section.
J. C. Priscu, J. Verduin, and J. E. Deacon.
Archiv fur Hydrobiologie, Vol 94, No 1, p 1-23, April, 1982. 12 Fig, 3 Tab, 36 Ref.

Descriptors: Productivity, *Phytoplankton, *Nutrients, Lakes, Reservoirs, Hypolimnion, Flow pattern, *Primary productivity, Stratification, Thermal stratification, Nitrogen, Phosphorus, *Lake Mohave, Lake Mead, Hoover Dam, Davis Dam, *Colorado River.

Primary productivity of phytoplankton was studied at 4 sites in Lake Mohave, a reservoir on the Colorado River, and at one site on the Colorado River upstream of the reservoir. Sampling was

done from October 1976 to September 1977. Lake Mohave, impounded by Davis Dam, receives its water from a 61 m depth (hypolimnion) in Lake Mead. In flows from this source, rich in dissolved N and P, and low in phytoplankton, are highly variable in time and volume. During thermal stratification the Colorado River water flows under the Lake Mohave epilimnion. At this time productivity averaged 3474 mg C per sq m per day just beneath the underflow. Here the peaks of phytoplankton biomass were significantly correlated with large Hoover Dam discharges about a month earlier. Productivity in the rest of the reservoir averaged 1700 mg C per sq m per day. Less than 5% of the nutrients (19,370 kg total N per day and 725 kg total P per day) were retained in the reservoir. (Cassar-FRC)
W83-00394

DISSOLVED HUMIC MATERIALS: PHOTODEGRADATION, SEDIMENT EFFECTS, AND REACTIVITY WITH PHOSPHATE AND CALCIUM CARBONATE PRECIPITATION,
Oak Ridge National Lab., TN.
A. J. Stewart, and R. G. Wetzel.
Archiv fur Hydrobiologie, Vol 92, No 3, p 265-286, October, 1981. 12 Fig, 2 Tab, 33 Ref.

Descriptors: *Phosphates, *Humic acids, *Degradation, Nutrients, Calcium carbonate, Algae, Fulvic acids, Organic matter, Lakes, Photodegradation, Sediments, Lake sediments, Hydrogen ion concentration, Intertidal areas, Light intensity, Littoral environment, Lawrence Lake, *Michigan.

The relative importance of photolysis, sediment type and pH in regulating the quality and quantity of dissolved humic materials (DHM) was determimed in a small hard water lake, Lawrence Lake, Michigan. The relationships between DHM-orthophosphate and DHM-calcium carbonate precipitation were also examined. Fluorescing components of humic substances from 5 sources, purified and natural, were degraded by ultraviolet light to 50% of initial values within 2-95 min. These substances in the Lawrence water sample were completely degraded within 16 min. Full natural sunlight exposure also degraded humic materials. Photolysis was faster in younger DHM and in lower molecular weight DHM. Therefore, sunlight can be an important factor in regulating DHM in shallow littoral zones and in the photic zone. Under basic conditions organic-rich sediments absorbed DHM of high molecular weight leaching from vegetation during rain events and slowly released lower molecular weight DHM between rain events. In the sphagnum sediments at lower pH, DHM of high molecular weight was released more rapidly than DHM of lower molecular weight and was strongly adsorbed by the Lawrence Lake inlet sediments. Binding of DHM to orthophosphate was not demonstrated under conditions similar to those in the epilimnion of Lawrence Lake. However, in more acid lakes orthophosphate-DHM binding may be an important factor in regulating the availability of orthophospahte. Low concentrations (< 2 mg per liter) of fulvic substances inhibited the calcium carbonate precipitation by algae under ambient conditions. C14 assimilation was not significantly changed in the short-term experiments (up to 3 days). Thus intensive rainstorms, washing DHM into the pelagic zone, could make more phosphate available by retarding coprecipitation with Ca. (Cassar-FRC)
W83-00397

MICROBIAL COMMUNITIES IN LAKE PLUSSEE--AN ANALYSIS WITH NUMERICAL TAXONOMY OF ISOLATES,
Max-Planck-Inst. fuer Limnologie zu Ploen (Germany, F.R.).
K.-P. Witzel, H. J. Overbeck, and K. Moaledj.
Archiv fur Hydrobiologie, Vol 94, No 1, p 38-52, April, 1982. 4 Fig, 1 Tab, 43 Ref.

Descriptors: *Bacteria, *Seasonal variation, *Taxonomy, Lakes, Lake Plussee, *West Germany, Microorganisms, Cluster analysis, Eutrophic lakes.

One hundred twenty-four bacterial strains were isolated from water samples collected from eutrophic Lake Plussee, Germany, June 1967 to September 1968 at depths of 1 to 7 m. Analysis of each isolate for 105 biochemical, cultural, morphological, and physiological characteristics and application of cluster analysis produced a set of 9 clusters comprising 3-35 strains each from 108 of the strains. Besides a core of bacterial strains present at all seasons and depths there were specialized components appearing under special environmental conditions. In winter only the core strains were present. Additional clusters were present in spring, summer, and autumn. Some clusters were also common to both spring and summer. (Cassar-FRC)
W83-00399

TRACE METAL SPECIATION IN THREE VICTORIAN LAKES,
Caulfield Inst. of Tech. (Australia). Dept. of Chemistry.
For primary bibliographic entry see Field 5A.
W83-00412

AN INDEX OF LITTORAL ZONE COMPLEXITY AND ITS MEASUREMENT,
Toronto Univ. (Ontario). Dept. of Zoology.
C. Kent, and J. Wong.
Canadian Journal of Fisheries and Aquatic Sciences, Vol 39, No 6, p 847-853, June, 1982. 6 Fig, 3 Tab, 18 Ref.

Descriptors: *Lake morphology, *Littoral zone, *Shores, Fractal equations, Geomorphology, Maps, Lake shores, Physical properties, *Ontario, Canadian Shield.

Shoreline length and littoral area were accurately characterized by computer digitization of maps of 8 lakes in the Canadian Shield in Ontario. Map scales varied from 1:25,000 to 1:500,000. Patterns in lake shoreline lengths drawn from maps of different scales were described and found to hold for many different lakes in the same geological province. By considering at least 2 different geomorphological processes which form a lake shoreline, it was possible to extrapolate shore lengths from large to fine-scale measurements without losing accuracy. The fractal measuring theory explained the empirical results and allowed predictions about statistical properties of groups of lakes, such as the relationship between lake area vs. shoreline length. For the lakes under study the value of D in Korchak's law (the shoreline development index, or degree of shoreline convolution) was 1.51, in agreement with measured results. Fractal indexes may be useful in explaining lake biological community structure, littoral productivity, erosional processes, and landforms. (Cassar-FRC)
W83-00414

THE EUTROPHICATION OF CAYUGA LAKE: A HISTORICAL ANALYSIS OF THE PHYTOPLANKTON'S RESPONSE TO PHOSPHATE DETERGENTS,
Massachusetts Univ., Amherst. Water Resources Research Center.
For primary bibliographic entry see Field 5C.
W83-00509

THE INFLUENCE OF RIVER FLOW ON PELAGIC SARDINE CATCHES IN LAKE KARIBA,
Lake Kariba Fisheries Research Inst. (Zimbabwe).
B. E. Marshall.
Journal of Fish Biology, Vol 20, No 4, p 465-469, April, 1981. 2 Fig, 3 Tab, 15 Ref.

Descriptors: *Fish farming, *Nutrient requirements, Lakes, Africa, Lake Kariba, Zambezi River, Rivers, Nutrients, Sardines, Rainfall, Flooding, Fisheries, *Zimbabwe.

Nutrient levels were examined in Lake Kariba, a man-made lake on the Zambezi river. It has a very large outflow in relation to its volume. The Zambezi is the most important river flowing into the lake and provides about 70% of the lake's water. Two other tributaries, the Gwaai and the Sanyati, supply about 10%, and 7% comes from direct rainfall on the lake surface. The flow of the rivers is seasonal, and they flood during the rainy season from November to February. The Zambezi has a relatively low nutrient level compared to other African rivers. The other tributaries are richer in nutrients and have an appreciable local effect on sardine catches in the lake. This is shown by increased catches of Limnothrissa miodon after strong flows have occurred in the Sanyati river. No such correlation has been found between sardine catches and flow from the Zambezi River. Thus prolonged periods of poor rainfall could have a major impact on the sardine fishery and climatic conditions are a factor that must be considered in planning management policies for sardine farms. (Baker-FRC)
W83-00518

SEASONAL AND SPATIAL DISTRIBUTION OF HUMUS FRACTIONS IN A CHAIN OF POLYHUMIC LAKES IN SOUTHERN FINLAND,
Helsinki Univ. (Finland). Dept. of Limnology.
V. Pennanen.
Hydrobiologia, Vol 86, No 1/2. p 73-80, January, 1982. 4 Fig, 3 Tab, 28 Ref.

Descriptors: *Humic acids, *Colloids, *Stratification, Lakes, *Finland, Lake Hakojarvi, Gels, Filtration, Organic matter, Particulate matter.

Water from humic lakes in the Kokemaenjoki catchment, Finland, was fractionated on Sephadex G-100 columns. The method produced four fractions: f1, fast eluting, large molecules; f2 slow eluting, small molecules; fo, the fraction between f1 and f2; and fx, the particulate fraction retained on the column and otherwise lost during elution. Fractions fx (particulate) and f1 (colloidal) showed very weak fluorescence, high light scattering, and high total iron levels. Fractions fo and f2, dissolved, showed no light scattering, moderate fluorescence, and occasional iron content. Organic carbon levels were high in f2, noticeable in f1 and fo, and uncertain in fx. Fractions fo and f2 were uniformly distributed in the water column, and fx and f1 were regularly stratified. Seasonal variation of the fx and f1 fractions varied strongly both temporarily and spatially in 3 groups of samples: (1) terrestrially-influenced, (2) 1-9 m layer of Lake Hakojarvi, and (3) 15-16 m (near bottom) layer of Lake Hakojarvi. (Cassar-FRC)
W83-00521

CARBON, PHOSPHORUS AND NITROGEN BUDGETS OF THE LITTORAL EQUISETUM BELT IN AN OLIGOTROPHIC LAKE,
Tvarminne Zoological Station (Finland).
J. Sarvala, T. Kairesalo, I. Koskimies, A. Lehtovaara, and J. Ruuhijarvi.
Hydrobiologia, Vol 86, No 1/2, p 41-53, January, 1982. 3 Fig, 2 Tab, 49 Ref.

Descriptors: *Nutrients, *Littoral zone, *Macrophytes, Carbon, Nitrogen, Phosphorus, Oligotrophic lakes, Lakes, Lake Paajarvi, *Finland, Sediments, Zooplankton, Phytoplankton, Benthic fauna, Fish, Equisetum, Aquatic plants, Cycling nutrients, Productivity.

The role of the littoral macrophyte, Equisetum, in the carbon, phosphorus, and nitrogen budgets of an oligotrophic, mesohumic lake was studied in Lake Paajarvi, Finland, during 1979-80. Through all seasons the major store for organic C, N, and P was the sediments. The second most important reservoir of these materials, and the most important living component, was the Equisetum. In spring only the dead remains of the macrophyte were present above ground. Nutrient, chlorophyll a, and zooplankton concentrations were similar in the littoral area and in the open lake; phytoplankton and epiphytes were the major producers. By early June new Equisetum shoots had reached the surface, and water exchange between the littoral zone and open lake started to decrease. By August phosphorus, chlorophyll a, and zooplankton concentrations in the macrophyte stand were 5-10 times higher than in the open lake. Equisetum dominated biomass and production from late June until autumn, with a peak in August. At this time C and nutrient stores were 100 times those of the other living components and 30-50 times higher than the total

C and nutrient contents of water. The rate of internal cycling of carbon and nutrients was high. P was the limiting nutrient, as suggested by the high N:P ratios. The annual production of Equisetum contained 2.3% of the mean annual P load and 5.3% of the mean total P storage in the water volume of the lake. Figures gave the C, P, and N distribution in the main components of the littoral ecosystem. (Cassar-FRC)
W83-00522

ESTABLISHING THE PATTERN OF HETEROTROPHIC BACTERIAL ACTIVITY IN THREE CENTRAL AMAZONIAN LAKES,
Max-Planck-Inst. fuer Limnologie zu Ploen (Germany, F.R.).
H. Rai, and G. Hill.
Hydrobiologia, Vol 86, No 1/2, p 121-126, January, 1982. 4 Fig, 13 Ref.

Descriptors: *Bacteria, *Seasonal variation, *Trophic level, Lakes, Amazon, Heterotrophic bacteria, Primary productivity, Chlorophyll a, Nutrients, Nitrates, Phosphates, Water level fluctuations, Lake Janauari, Lake Cristalino, Lake Tupe, Algal growth, Productivity, Floating plants, *Brazil.

Seasonal trends in heterotrophic activity (Vmax) were studied in 3 central Amazonian lakes. Lago Janauari, a 79 ha mixed water Ria/Varzea lake, supports the growth of floating meadows composed of Paspalum repens and Echinochloa polystachya. Lago Cristalino (24 ha) and Lago Tupe (68 ha) are black water lakes. Water levels, nutrient concentrations, and chlorophyll a levels all controlled heterotrophic activity, which varied greatly from ologotrophic to eutrophic and back to oligotrophic over the course of a year. In January the decomposition of floating plant meadows was the regulating factor in heterotrophic activity. The plants, which started to decompose and release carbon during low water levels in January, produced a sharp rise in Vmax to a peak of 312 micrograms glucose per liter per hour in the water column. Minimum Vmax (nearly zero) was in the early part of the dry season (July-September). In Cristalino the natural substrate caused Vmax to fluctuate from 0.04 micrograms per liter per hour at the surface in July to 9.64 micrograms per liter per hour in October. In October total bacterial densities were 112 million per liter, of which only 0.17% were saprobic bacteria. From May to October there was a positive relation between Vmax and phosphorus. In Tupe Vmax at the surface (0.09 to 9.3 micrograms glucose per liter per hour) was controlled by algal growth. As algae died off, releasing glucose, Vmax increased to a major peak in December and a minor peak in September. Nitrates, phosphates, and water levels, in turn, controlled algal growth. (Cassar-FRC)
W83-00523

NUTRIENT DEPENDENCE OF PHYTOPLANKTON PRODUCTION IN BROWN-WATER LAKES WITH SPECIAL REFERENCE TO LAKE PAIJANNE,
Hydrobiolofical Research Inst., Jyvaskyla Univ. (Finland).
For primary bibliographic entry see Field 5C.
W83-00524

LIMNOLOGICAL RESEARCH CAN IMPROVE AND REDUCE THE COST OF MONITORING AND CONTROL OF WATER QUALITY,
Uppsala Univ. (Sweden). Inst. of Limnology.
For primary bibliographic entry see Field 5G.
W83-00526

THE ANNUAL FLOOD REGIME AS A REGULATORY MECHANISM FOR PHYTOPLANKTON PRODUCTION IN KAINJI LAKE, NIGERIA,
Outokumpu Oy, Kokkola (Finland). Kokkola Works.
S.-G. Karlman.
Hydrobiologia, Vol 86, No 1/2, p 93-97, January, 1982. 4 Fig, 18 Ref.

Descriptors: *Phytoplankton, *Productivity, *Turbidity, Lakes, Lake Kainji, *Nigeria, Primary productivity, Light penetration, Seasonal variation, Floods, Tropical regions, Optical properties, Transparency.

Phytoplankton production in Kainju Lake, Nigeria, was affected by the annual flood pattern: the black flood, a clear water flood rising from August or September and peaking in January-February, and the white flood, a flow of local-origin turbid water peaking in August-September. This lake has a flow-through ratio of 4:1, giving it the character of a wide slow-flowing river. Production was measured in situ from December 1970 to September 1972. Oxygen production was 220-4500 mg 02 per sq m per day. During the white flood light transparency was low (1% light attenuation at less than 1 m) and phytoplankton production was correspondingly low. In April-July phytoplankton production was highest, correlating with high transparencies (1% transmission at about 7 m). (Cassar-FRC)
W83-00529

THE EFFECT OF LAND USE ON THE DIATOM COMMUNITIES IN LAKES,
Joensuu Univ. (Finland). Karelian Inst.
For primary bibliographic entry see Field 5C.
W83-00530

CONVECTION IN BOTTOM SEDIMENTS AND ITS ROLE IN MATERIAL EXCHANGE BETWEEN WATER AND SEDIMENTS,
Water Protection Association of Savo, Kuopio (Finland).
For primary bibliographic entry see Field 5B.
W83-00531

THE SEASONAL CYCLE OF INORGANIC CARBON SPECIES IN CAZENOVIA LAKE, NEW YORK, 1977,
Syracuse Univ., NY. Dept. of Civil Engineering.
S. W. Effler, S. D. Field, and M. Quirk.
Freshwater Biology, Vol 12, No 2, p 139-147, April, 1982. 6 Fig, 20 Ref.

Descriptors: *Carbon cycle, *Lakes, *Seasonal variations, Metabolism, *Cazenovia Lake, *New York, Carbon dioxide, Carbonates, Chemical reactions, Hypolimnion, Carbon, Thermal stratification, Stratification, Epilimnion, Littoral zone.

The spatial and temporal distributions of inorganic carbon and related forms were determined for Cazenovia Lake, New York, to evaluate the sensitivity of the carbonate system to biological and physical processes. Cazenovia Lake is a small shallow lake, located in Central New York State. The lake is mostly spring fed, moderately rich in inorganic carbon, and subject to very little cultural influence. Samples were collected weekly for 1 year, from one pelagic and two widely separated littoral sites on the lake. The carbonate chemistry results for Cazenovia Lake depict temporal and spatial trends that are in general agreement with those described for other hardwater systems. During summer stratification the epilimnion is rich in light compared to the hypolimnion. Photosynthesis consumes carbon dioxide in the upper waters, resulting in reduced H2C03, increased pH and carbonate ions and thus an increased degree of calcium carbonate saturation. Usually less photosynthesis and more respiration and biochemical oxidation occur in the light-poor hypolimnion. During winter ice-covers, the entire lake is light poor and behaves similarly to the hypolimnion during summer stratification. Photosynthesis is limited to the uppermost layers, and mixing is very limited. Analysis of potentially influencing factors indicates that the seasonal trends were mostly a result of carbon dioxide metabolism. (Baker-FRC)
W83-00532

THE PALAEOLIMNOLOGY OF LAKE MYVATN, NORTHERN ICELAND; PLANT AND ANIMAL MICROFOSSILS IN THE SEDIMENT,
Iceland Univ., Reykjavik. Inst. of Biology.
A. Einarsson.
Freshwater Biology, Vol 12, No 1, p 63-82, February, 1982. 5 Fig, 1 Tab, 70 Ref.

Descriptors: *Paleolimnology, *Cold regions, Lakes, Limnology, *Iceland, Algal growth, Lake Myvatn, Ecosystems, Microbiological studies, Cladophora, Chlorophyta, Algae, Lake sediments.

Paleolimnological evidence is presented for the existence of Lake Myvatn I. The lake is divided into three basins on physical, chemical and biological grounds: the Sydrifloi, Ytrifloi and Bolir basins. Myvatn lies between two north-south trending fissure swarms. The eastern fissure swarm has been very active in the vicinity of Myvatn, and postglacial lava fields of different ages form the bedrock of the lake basins. The sediment of the lake is pure diatomaceous gyttja, is mostly between 3 and 6 meters thick and is relatively homogeneous in the Ytrifloi basin. In the Sydrifloi basin the gyttja is replaced by a very sandy layer of unknown origin at the 3-6 meter region in certain localities. The succession of diatoms within sediment cores can be divided into four zones with the first from 0-187 cm, second from 187-225 cm, third from 225-240 cm, and fourth from 240-285 cm. Numerous pseudocraters in the vicinity are of several types, giving evidence of the prehistory of the lake. Most of the craters are of the platform type. Crater cones are made usually of coarse scoria, sometimes of spatter. The diatom flora was identical in almost all the craters investigated. At 90 cm deep (around 1600 AD) in the Sydrifloi sediment a simultaneous increase occurred in Cladophora aegagropila (Chlorophyta), Eurycerus lamellatus (Cladocera) and three diatom species epiphytic on Cladophora. The increase in Cladophora may have been caused by improved light conditions on the bottom, either because of a decrease in water depth due to sedimentation, or a decrease in Anabaena blooms or both. (Baker-FRC)
W83-00533

GRAFHAM WATER: A DISCUSSION OF LIMNOLOGICAL EVENTS DURING THE 5-YEAR PERIOD 1974-1978,
Anglian Water Authority (England).
R. F. Stent.
Freshwater Biology, Vol 11, No 6, p 567-578, December, 1981. 5 Fig, 5 Tab, 17 Ref.

Descriptors: *Algal growth, *Reservoirs, *Grafham Water, *England, Algae, Nutrients, Seasonal variation, Wind, Temperature effects, Drought, Reservoir operation.

In the period between 1974-78, the diversity of the algal population in Grafham Water, a lowland reservoir, appeared to have diminished somewhat. At least a few successful species have dominated the lake for periods of the year, while numbers of once-abundant forms have dropped. This may be partly due to the massive inflow of nutrients and unusual conditions following the drought of 1976. The lake is now returning to former conditions with a drop in nutrient concentrations, including nitrate. It seems probable that algal nutrient levels will soon fall to their pre-drought levels unless abnormal conditions intervene. Future algal events affecting reservoir management and treatment may be asmuch controlled by climatic events as by nutrient concentrations. The effects of weather, particularly radiation and wind, on algae may be of equal importance to nutrient levels in Grafham and will be investigated. (Baker-FRC)
W83-00534

CHANGES IN SUBMERSED MACROPHYTES IN CHAUTAUQUA LAKE, 1937-1975,
North Dakota Univ., Grand Forks.
S. A. Nicholson.
Freshwater Biology, Vol 11, No 6, p 523-530, December, 1981. 1 Fig, 3 Tab, 31 Ref.

Descriptors: *Lakes, *Macrophytes, Potamogeton, Myriophyllum, *Chautauqua Lake, *New York, Eutrophication, Phytoplankton, Algal growth, Eutrophic lakes.

Changes in macrophyte richness, relative abundances, depth distributions and dominant species were assessed from the period of 1937 to 1975 in the eutrophic lake Chautauqua, located in western New York. The lake is of natural origin and has

two basins, a northern basin of 2856 ha, 7.8 meters in depth and 23 meters in maximum depth, and a southern basin of 2468 ha, 3.5 meters and 6 meters respectively. The north basin stratifies in deep spots at 7-9 meters, but the south basin does not stratify due to its shallowness. Eight factors could have contributed to changes in macrophyte communities from the 1930's, including climate, eutrophication, sedimentation, phytoplankton, attached algae, fish, zooplankton, and macrophyte management practices. Thirty-two macrophytes were recorded in 1972-75, as compared with 24 in 1937. The floras were quite similar, having nineteen species in common for a Sorenson index of 0.83. Many species exhibited notable changes in relative abundance from 1937 to 1972-75, mostly declines. As with species richness, declines were concentrated in the Potamogetonaceae, in which 10 of the original 15 species declined, 7 markedly so. A comparison of depth ranges occupied by species in 1937 and 1972-75 revealed only occasional deviations. Depth distributions of three newly recorded species, E. nuttallii, N. guadalupensis, and R. trichophyllous, were similar to those of their cogeners in 1937. The data suggest that no major changes in light regime have occurred and therefore no major increase in phytoplankton density such as would result from increasing eutrophication. (Baker-FRC)
W83-00535

COMPARISON BETWEEN THE CARBON-14 AND OXYGEN CONSUMPTION METHOD FOR THE DETERMINATION OF THE ACTIVITY OF HETEROTROPHIC BACTERIAL POPULATIONS,
Delta Inst. of Hydrobiological Research, Yerseke (Netherlands).
A. B. J. Sepers, G. Cahet, and H. Goossens.
Marine Biology (Berlin), Vol 66, No 3, p 237-242, 1982. 3 Fig, 3 Tab, 14 Ref.

Descriptors: *Mineralization, *Carbon radioisotopes, *Oxygen uptake, *Heterotrophic bacteria, Lakes, Amino acids, Lake Grevelingen, *The Netherlands, Etang Salses Leucate, *France, Bacteria.

The activity of heterotrophic bacteria as measured by carbon mineralization in Lake Grevelingen, the Netherlands (chlorinity 15-17 o/oo) and the Mediterranean Etang Salses Leucate, France (chlorinity 18 o/oo) was more accurately estimated by the oxygen consumption method than the method using C14-labeled substrates. Organic substances added to the lake waters were C14-labeled pyruvate, glycollate, and an amino acid mixture. The maximum uptake rate of the organic compounds was generally < 10% of the carbon mineralization rate calculated from oxygen consumption experiments. During January 1980 glycollate and pyruvate uptakes were 31-38%, with one unusual value for pyruvate, 149%. The higher % were found in winter when heterotrophic activity was low. In Etang Salses Leucate maximum uptake rates were 3.4-4.4% of the mineralization rate calculated from the oxygen consumption rate for the amino acids mixture, 9.7-19.6% for glycollate, and 8.5-34.9% for pyruvate. (Cassar-FRC)
W83-00569

OXYGEN CONSUMPTION AND AMMONIA AND PHOSPHATE EXCRETION IN POND ZOOPLANKTON,
Ceskoslovenska Akademie Ved, Prague. Inst. of Landscape Ecology.
P. Blazka, Z. Brandl, and L. Prochazkova.
Limnology and Oceanography, Vol 27, No 2, p 294-303, 1982. 4 Fig, 4 Tab, 35 Ref.

Descriptors: *Zooplankton, *Oxygen uptake, *Excretion, Ammonia, Phosphates, Cyclops, Daphnia, Invertebrates, Weight, Respiration, Protein, Nitrogen, Carnivores, Herbivores, Temperature effects, Metabolism, Copepods, *Czechoslovakia.

Oxygen consumption and the excretion of ammonia and phosphate were studied in zooplankton in a small eutrophic fish pond at Belice, Czechoslovakia. The principal species was the predatory copepod Cyclops vicinus. Oxygen consumption was linearly related to body size from 11 to 23C and proportional to the 0.86 power of size at 4C. Daphnia and Cyclops containing 1 microgram N took up about 68 microliters 02 per mg N per hour. The curve obtained from plotting oxygen consumption vs. temperature for Cyclops vicinus was similar to that obtained earlier for Daphnia hyalina (Blazka, 1967). Oxygen consumption (in microliters 02 per mg N per hr) was about 20 at 5C, about 50 at 15C, about 75 at 20C, and about 140 at 25C. Oxygen uptake decreased up to 45% in starved C. vicinus. Relationships of excretion rates for N and phosphate and body size were similar to those obtained from oxygen uptake. The oxygen equivalent of ammonia excretion for protein catabolism was never higher than measured oxygen uptake, suggesting that no glucogenesis or lipogenesis occurred in well-fed animals. Relative excretion rates of ammonia in both fasting and well-fed animals increased with concentrations of food present. Phosphate excretion rates also increased with increasing food concentrations, but results of individual experiments were not consistent. The herbivorous plankton had lower N exchange rates than the carnivores, showing that the relative excretion of ammonia increased throughout the food chain. P excretion rates in herbivores and carnivores were not significantly different. (Cassar-FRC)
W83-00571

ELECTRON MICROSCOPIC INVESTIGATION OF MICROORGANISMS IN WATERS OF DIFFERENT COLOR,
I. N. Krylova.
Hydrobiological Journal, Vol 17, No 3, p 22-27, 1981. 4 Fig, 9 Ref.

Descriptors: *Color, *Bacteria, *Morphology, Lakes, Humic acids, Organic matter, Microorganisms, *Electron microscopy, Epilimnion, Metalimnion, Hypolimnion, Oxygen, Dissolved oxygen, Temperature, Estonia, Lake Linayarvi, Lake Mustayarvi, Lake Pikkyarvi, *USSR.

Bacteria in highly-colored, humus-rich waters and in the stratified eutrophic Lake Linayarvi had similar forms at similar depths. Water bodies studied included 3 Estonian lakes: Linayarvi (10 degrees color), Pikkyarvi (240 degrees), Mustayarvi (300 degrees), and a bog stream (1100 degrees). However, temperature and oxygen content were important factors in defining distribution of bacterial forms. In the warm, oxygenated epilimnia of lakes, rod-like bacteria and cocci were most common. In metalimnia with less oxygen, rods, cocci, filamentous bacteria, spirochaetes, and bacteria with stripes and hyphae predominated. In the cold, anaerobic hypolimnia, rods with inclusions of various electron densities were found. (Cassar-FRC)
W83-00575

ECOLOGICAL AND PHYSIOLOGICAL PROFILE OF FILAMENTOUS GREEN ALGAE AS FACTORS IN THE PRODUCTION OF ORGANIC MATTER AND CONTROL OF WATER QUALITY,
Akademiya Nauk URSR, Kiev. Inst. Hidrobiologii.
I. M. Velichko.
Hydrobiological Journal, Vol 17, No 3, p 102-103, 1981.

Descriptors: *Oxygen balance, *Algae, *Self-purification, Photosynthesis, Nutrients, Filamentous algae, *Cladophora, Rhizoclonium, Chlorophyta, Organic matter, Biomass, Lakes, Productivity, Oxygen, Food chains, USSR.

Filamentous green algae in shallow regions of reservoirs play an important part in primary production, enrichment of water with oxygen, nutrient uptake, and self-purification of water. In a growing season this type of alga produces 2.2 g oxygen per g wet weight. Nitrogen comprises 2.65%, and P, 0.30%, of the algae dry weight. About 54% of the biomass is consumed by grazing animals, forming an important link in the food chain. Optimum conditions for Cladophora fracta Kuetz. and Rhizoclonium hieroglyphicum Kuetz. are 20C water temperature, 20,000-30,000 lux illumination, and 1 m compensation depth. The cells produce more oxygen than they respire at algal biomasses of 1-3 kg per cu m. Oxygen balance becomes zero at 6 kg per cu m. (Cassar-FRC)
W83-00576

DIEL DYNAMICS OF PHYTOPLANKTON IN LAKE KANDRY-KUL,
F. B. Shkundina.
Hydrobiological Journal, Vol 17, No 3, p 7-10, 1981. 2 Fig, 7 Ref.

Descriptors: *Phytoplankton, *Diurnal variation, Zooplankton, Grazing, Algae, Lake Kandry-Kul, Species composition, Species diversity, Oligotrophic lakes, Cyanophyta, Chlorophyta, Biomass, *USSR.

The diel variation in phytoplankton in the Bashkirian Lake Kandry-Kul was monitored in July 1979. This oligotrophic lake, 15.5 m deep, 1560 ha area, with a rich fish and bird population, has been recently exposed to recreational use. A total of 130 algal species were found: 10 blue-green algae, 5 pyrrophytes, 51 bacillariophytes, 6 euglenophytes, 3 xanthophytes, and 55 chlorophytes. Dominant species were Gomphosphaeria lacustris Chod. f. lacustris, Gymnodinium fungiforme Aniss., Crucigenia quadrata Morren, Oocyctis lacustris Chod., and Tetrachlorella alternans Korschik. Greatest species diversity was seen at 8 am at 3 m depth (53 species in 1 sample). Overall abundance and biomass was minimum at 3 pm and maximum at 7 pm. Cyanophytes and bacillophytes were most abundant in evening. Protococcaceae and zygnamatales were most abundant at night and during early morning. Reasons for these variations were grazing by zooplankton and changes in the physical and chemical variables. (Cassar-FRC)
W83-00578

PHYTOPHILOUS ASSEMBLAGES OF ORGANISMS IN SARATOV RESERVOIR,
Akademiya Nauk SSSR, Tolyatti. Inst. Biologii Vnutrennykh Vod.
V. I. Popchenko, L. V. Lomakina, and I. I. Popchenko.
Hydrobiological Journal, Vol 17, No 2, p 10-14, 1981. 1 Tab, 5 Ref.

Descriptors: *Macrophytes, *Reservoirs, Aquatic plants, Saratov Reservoir, *USSR, Volga River, Littoral zone, Invertebrates, Plant growth, Plant populations, Organic matter, Fish food organisms.

Saratov Reservoir on the Volga River was created in 1968. About 5-6% of its surface is covered by macrophytes, located in the middle island region and along inundated flood plains. During 1974-77 the 7 plant biotypes were surveyed: lesser reedmance, flowering reed, shining pondweed, willowgrass, yellow and white water lilies, and hornwort in conjunction with Salvinia and duckweed. The zonal distribution of higher water plants is dependent on depth. Growth begins in early June, and reaches maturity by the end of June. Die-off begins in July and reaches a peak in September-October. Peak development for fauna is July-August; for algae, August. The most productive beds are reedmace, pondweed, and hornwort-Salvinia-duckweed. Other biotypes are 5-15 times less productive. This study shows that the higher water plants are a significant factor in the life of the reservoir and must be considered in planning. (Cassar-FRC)
W83-00579

DISPERSION PATTERNS OF PHYTOPLANKTON IN LAKES,
Loughborough Univ. of Technology (England). Dept. of Human Sciences.
R. I. Jones, and R. C. Francis.
Hydrobiologia, Vol 86, No 1/2, p 21-28, January, 1982. 3 Fig, 3 Tab, 38 Ref.

Descriptors: *Phytoplankton, *Spatial distribution, *Sampling, Algae, Lakes, Statistics, Patchiness, Mathematical studies, *England.

Horizontal spatial variation of phytoplankton in a lake was investigated by collecting samples of

varying size from Charnwood Water, a disused gravel pit in Leicestershire, England. The mean cells per ml counted in 20 samples each of 0.1, 0.5, 1, 5, and 10 ml volume were Chroomonas, 336-440; Euglena, 7.6-17.2; Cryptomonas, 0.9-3.5; and Melosira italica, 1.0-1.9. No consistent pattern in the values was discerned. Chroomonas and Euglena showed considerable variance from Poisson distribution at all sample volumes, indicating a contagious distribution. Cryptomonas and Melosira appeared to be randomly distributed in all samples but the 1 and 5 ml sizes (evaluated by the significance of departure from random expectation method) and 0.1 to 1 ml sizes (evaluated by the Morisita index of dispersion). Since most lake water sampling uses a much larger sample size, the micro-contagion demonstrated here is not expected to be significant. However, subsamples used for cell counts should be truly representative. (Cassar-FRC)
W83-00581

DISTRIBUTION OF LITTORAL CRUSTACEANS IN THE PELAGIC ZONE OF LAKE GLUBOKOYE,
N. M. Korovchinskiy.
Hydrobiological Journal, Vol 17, No 3, p 17-21, 1981. 1 Fig, 1 Tab, 10 Ref.

Descriptors: *Zooplankton, *Substrates, *Pelagic zone, Littoral zone, *Crustaceans, Invertebrates, Lake Glubokoye, Species composition, Lakes, Sida crystallina, Floating, Cladocerans, *USSR.

Representatives of 16 littoral crustacean species (11 Cladocera, 3 Cyclopoida, and 2 Ostracoda) were found in the pelagic zone of Lake Glubokoye near Moscow in summer-autumn of 1977. The lake was 15-20 m deep 150-300 m from shore at the study site. Sida crystallina was hundreds of times more abundant than other crustaceans. The constant communication between littoral and pelagic communities is a result of passive transport. Substrates such as floating leaves, debris, boats, and floats encourage movement of the zooplankton, especially in the autumn, as floating leaves are numerous. S. crystallina apparently adapt well to changes from the littoral to the pelagic environment. In fact, fecundity is higher in the pelagic area than in the littoral area because sexually mature females readily cling to the floating substrate and pressures present in the littoral zone are absent in the pelagic area. (Cassar-FRC)
W83-00595

DESTRUCTION OF ORGANIC MATTER BY HIGHER WATER PLANTS UNDER EXPERIMENTAL CONDITIONS,
Akademiya Nauk SSSR, Borok. Inst. Biologii Vnutrennykh Vod.
V. M. Kudryavtsev.
Hydrobiological Journal, Vol 17, No 2, p 43-46, 1981. 2 Fig, 2 Tab, 8 Ref.

Descriptors: *Organic matter, *Decomposition, *Microorganisms, Lakes, Macrophytes, Aquatic plants, Degradation, *Biodegradation, Water lily, Bulrush, Pondweed, Rybinsk Reservoir, *USSR, Oxygen uptake, Bacteria, Fungi.

Degradation of organic matter from aquatic macrophytes (white water lily, bulrush, and shining pondweed) was studied by adding 1 g of pulverized dying plant matter to laboratory bottles and allowing decomposition for 216 days. Total oxygen consumption over the entire study period was 52.29 mg per liter with water lily, 64.5 mg per liter with bulrush, and 29.42 mg per liter with pondweed, 5 to 11 times that of the control, which contained water but no plants. Intensive uptake of oxygen was observed on the first day. It reached a peak on the third day, after which it declined gradually. Total quantity of bacteria reached a maximum of 8.2 million per ml on the third day and declined to 1-2 million per ml by the end of the experiment. The 3 plants decomposed at different rates. At the end of the sixth day 25% of the organic matter in water lily had been destroyed, but only 10% each of the other 2 plants. By the 24th day the percentage of original plant matter destroyed was 50% for water lily, 32% for bulrush, and 28% for pondweed. Final values (216th day) were 80% for water lily, 94% for bulrush, and 58% for pondweed. In the initial stages of decomposition saprophytic bacteria and fungi capable of mineralizing readily oxidizable substances predominated. Later on, cellulose-decomposers and molds using more unavailable compounds were active. (Cassar-FRC)
W83-00597

BIODEGRADATION OF CELLULOSE IN BOTTOM SEDIMENTS OF LAKE BAIKAL,
Irkutskii Gosudarstvennyi Univ. (USSR). Lake Baikal Biological Station.
For primary bibliographic entry see Field 5B.
W83-00600

THE ROLE OF NITROGEN AS A GROWTH LIMITING FACTOR IN THE EUTROPHIC LAKE VESIJARVI, SOUTHERN FINLAND,
National Board of Water, Helsinki (Finland). Water Research Inst.
J. Kanninen, L. Kauppi, and E. -R. Yrjana.
Hydrobiologia, Vol 86, No 1/2. p 81-85, January, 1982. 4 Fig, 1 Tab, 20 Ref.

Descriptors: *Nitrogen fixation, *Nutrients, *Phytoplankton, *Lakes, Limiting nutrients, Nitrates, Phosphates, Lake Vesijarvi, *Eutrophic lakes, *Finland, Biomass, Cyanophyta, Selenastrum, Algal growth, Growth kinetics.

The role of nitrogen in algal growth was investigated in eutrophic Lake Vesiharvi, Finland, during the summers of 1979 and 1980, using Selenastrum capricornutum and Anabaena cylindrica as test organisms. Total N levels varied from 540 to 1400 micrograms per liter and total P from 34 to 310 micrograms per liter. In both years N limited the growth of Selnastrum from May to mid-August. P was limiting for Anabaena, a nitrogen-fixer. Nitrogen fixation and number of heterocysts (on the order of 500,000 per liter) both reached a peak in early July. As ratios of inorganic N to phosphate P decreased to a minimum in July-August, the blue-green algae became dominant, 23-34% of total biomass. (Cassar-FRC)
W83-00604

STUDIES OF THE LIMNOLOGY, FISH POPULATIONS, AND FISHERY OF TURQUOISE LAKE, COLORADO - 1979-80,
Colorado Div. of Wildlife, Fort Collins.
T. P. Nesler.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-110072, Price codes: A03 in paper copy, A01 in microfiche. Bureau of Reclamation Report REC-ERC-82-5, July 1981. 37 p, 5 Fig, 17 Tab, 21 Ref, 5 Append. 7-07-83-V0701.

Descriptors: *Reservoirs, *Reservoir fisheries, *Storage reservoirs, *Fish populations, Colorado, Twin Lakes, Pumped storage, Trout, Fish stocking, Salmon, Nutrients, Oxygen depletion, Oligotrophic lakes, Water temperature, Daphnia, Diatoms.

Turquoise Lake is one of the primary storage reservoirs in the Fryingpan-Arkansas Water Project and provides supplementary water by conduit to the Mt. Elbert Forebay-Twin Lakes system for pump-back storage power generation. The reservoir may be characterized as a dimictic, cold-water lake that is well oxygenated, relatively unbuffered, and slightly acidic. The lake may be classified as oligotrophic on the basis of total dissolved solids, algal nutrients (N-P), and chlorophyll concentrations. Depletion of dissolved oxygen occurs regularly in the hypolimnion during late summer and late winter. Turquoise Lake is limnologically similar to Twin Lakes (Colo.) in most respects, but Twin Lakes may be affected by the colder temperatures of the water imports from Turquoise Lake and from the introduction of Tabellaria and Daphia. The Turquoise Lake fishery is based on the stocked, creel-sized rainbow trout (Salmo gairdneri Richardson), which made up 95% of the 1980 summer harvest. Catch rates have remained in the 0.59-0.70 fish/hour range between 1972-73 and 1980 despite similar levels of rainbow trout stocking and a 45% increase in fishermen effort to 62 000 man-hours (84 hours/hectare). Marked rainbow trout returned in the harvest at only a 28% return rate during one summer season but continued to contribute to the fishery in the following year. Fall stocking of rainbow trout and a good winter survival of these fish contributed significantly to high catch rates in the following spring and summer. Lake trout (Salvelinus namaycush Walbaum) have been unable to establish a self-sustaining population in the reservoir and recruitment past a 356 mm length or 5 years is negligible. The lake trout population must be maintained by periodic stocking. Turquoise Lake demonstrates potential as a kokanee salmon (Oncorhynchus nerka Suckley) fishery and spawn source. (Author's abstract)
W83-00640

INTERACTION OF BACTERIAL PLANKTON AND ZOOPLANKTON IN OLIGOTROPHIC WATER BODIES,
Akademiya Nauk SSSR, Novosibirsk. Inst. of Limnological.
E. L. Afanas'eva, and M. A. Messineva.
Water Resources, Vol 8, No 4, p 457-461, July/August, 1981. 1 Fig, 2 Tab, 4 Ref. Translated from Vodnye Resursy, No 4, p 180-184, July/August, 1981.

Descriptors: *Zooplankton, *Self-purification, *Bacteria, Baccilli, Cocci, Plankton, *Oligotrophic lakes, Crustaceans, Invertebrates, Food habits, Feeding rates, *Lake Baikal, *USSR, Lakes, *Epischura baicalensis.

The crustacean, Epischura baicalensis Sars, was exposed for 24 hours in situ in oligotrophic Lake Baikal in five experiments in March and six in April, 1977. Cocci were the predominant bacterioplankton consumed by Epischura, one crustacean eating 365,000-2.6 million cells per day in March and 200,000-945,000 cells per day in April. In three of the April experiments the consumption of bacilli was detected, amounting to as much as 57% of bacteria consumed. Utilization of the cocci was independent of their initial concentration. Percent of utilization of cocci varied from 19 to 66.3% in March and 12.6 to 49.5% in April. (Cassar-FRC)
W83-00648

LAKE ERIE CLADOPHORA IN PERSPECTIVE,
Ecology and Environment, Inc., Buffalo, NY.
G. C. Millner, and R. A. Sweeney.
Journal of Great Lakes Research, Vol 8, No 1, p 27-29, 1982. 1 Fig, 11 Ref.

Descriptors: *Lakes, *Algal growth, Algae, *Lake Erie, Great Lakes, Nutrients, Seasonal variations, Eutrophication, *Cladophora.

The growth rate, density and distribution of Cladophora were investigated in Lake Erie to determine possible relationships between environmental conditions and Cladophora growth and to establish a systematic data base formulated from the results of U.S. and Canadian studies. The study was conducted over a 2 year period at locations in all three basins of Lake Erie. Each basin displayed a characteristic set of limnological conditions. In general, nutrient concentrations and mean water temperature decrease from west to east, while light penetration increases. These limnological conditions are largely a function of the physical nature and nutrient loading to these basins and are largely responsible for differences in Cladophora growth across the lake. (Baker-FRC)
W83-00661

ECOLOGICAL STUDIES AND MATHEMATICAL MODELING OF CLADOPHORA IN LAKE HURON: 3. THE DEPENDENCE OF GROWTH RATES ON INTERNAL PHOSPHORUS POOL SIZE,
Michigan Technological Univ., Houghton. Dept. of Civil Engineering.
M. T. Auer, and R. P. Canale.
Journal of Great Lakes Research, Vol 8, No 1, p 93-99, 1982. 9 Fig, 23 Ref.

Descriptors: *Algal growth, *Lakes, *Lake Huron, Great Lakes, *Phosphorus, Mathematical models, Model studies, *Cladophora, Algae, Eutrophication.

The relationship between growth rate and internal phosphorus content for Cladophora glomerata was defined. Algal samples were harvested from Lake Huron to represent a range of internal phosphorus concentrations. Rates of net photosynthesis and respiration were measured under controlled conditions of light and temperature using a dissolved oxygen technique. The net specific growth rate and respiration rate were calculated from photosynthesis and respiration measurements using a fixed stoichiometric relationship and the measured carbon content of the algae. The maximum rates for net specific growth rate, gross specific growth rate, and specific respiration rate were 0.77, 1.08, and 0.44/day, respectively. Management decisions may be importantly influenced by these relationships. A non-linear response by growth to reductions in phosphorus loading is suggested from these findings. The internal nutrient status of algal populations must be considered in predicting the impact of phosphorus management strategies on aquatic systems. (Baker-FRC)
W83-00662

VERTICAL CIRCULATION IN DENSITY-STRATIFIED RESERVOIR,
Technical Univ. of Szczecin (Poland). Inst. of Water Engineering.
Z. Meyer.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 108, No HY7, p 853-873, July 1982. 11 Fig, 21 Ref.

Descriptors: *Mathematical models, *Model studies, *Reservoirs, *Density stratification, *Physical properties, Wind, Currents, Flow, Density, Stratification, Density currents, Boundary conditions, Shear stress, Waves.

A mathematical model of vertical circulation in a density-stratified reservoir is presented. The model assumes a two dimensional flow within a rectangular and a semi-infinite strip shaped reservoir. The solutions allow inclusion of a flow generated by inflow and outflow, and wind generated circulation. Basic parameters of the solution are: 1) Boundary conditions at the inflow and outflow; 2) density stratification; 3) surface shear stress or surface velocity at the inflow; and 4) eddy viscosity coefficients. The vertical circulation flow patterns obtained by this model are in good agreement with previous models, and the model includes more factors which have a significant influence on the flow. In particular, horizontal density changes, different eddy viscosities, and the location and strength of inflow and outflow orifices are included. Further research on vertical circulation given vanishing density gradients or axially symmetric flow is needed to provide more general solutions. (Titus-FRC)
W83-00676

2I. Water In Plants

A COMPARATIVE ANALYSIS OF THE C02 AND WATER VAPOR RESPONSES OF TWO SPARTINA SPECIES FROM GEORGIA COASTAL MARSHES,
Smithsonian Institution, Washington, DC. Office of Biological Conservation.
J. R. Giurgevich, and E. L. Dunn.
Estuarine, Coastal and Shelf Science, Vol 12, No 5, p 561-568, 1981. 3 Fig, 1 Tab, 15 Ref.

Descriptors: *Marsh plants, *Transpiration, *Water use efficiency, Carbon dioxide, Soil-water-plant relationships, *Spartina, *Salt marshes, Coastal marshes, Marshes, Stomatal transpiration, Photosynthesis, Temperature effects, Water vapor, Metabolism, Leaves, Conductance, *Georgia.

The carbon dioxide and water vapor exchange of Spartina cynosuroides and Spartina alterniflora were investigated in mid- April 1978 at a salt marsh on the Altamaha River, Georgia. The shape of the C02 response curves, the lack of change in this response at low oxygen concentrations (1-2%) and the low estimates of C02 compensation concentrations indicate that S. cynosuroides has C4 metabolism, as does S. alterniflora. S. cynosuroides showed a strong response of increasing net photosynthesis with increasing radiation. C02 release occurred at low radiation, but C02 exchange was positive at all other levels up to full sunlight at 25C. S. alterniflora showed a strong light response, but rates of photosynthesis were generally less. Both species showed a unimodal response to temperature, the net photosynthesis of S. cynosuroides being markedly higher than that of S. alterniflora. Transpiration of S. cynosuroides increased with increasing temperature and was always higher than the more flattened response curve of S. alterniflora. Water use efficiency of S. cynosuroides was less than that of S. alterniflora at temperatures above 20C. Leaf conductance of S. cynosuroides increased from 15 to 20C but declined progressively thereafter. Leaf conductance of S. alterniflora was also greatest at low temperature and declined more sharply with increasing temperature. Leaf conductance of both species increased with increasing radiation; values for S. cynosuroides were higher than those of S. alterniflora. Evidence suggests that photosynthesis in S. cynosuroides is controlled more by stomatal activity than by internal components; the reverse is true of S. alterniflora. (Cassar-FRC)
W83-00421

GROWTH AND RECESSION OF AQUATIC MACROPHYTES ON A SHADED SECTION OF THE RIVER LAMBOURN, ENGLAND, FROM 1971 TO 1980,
Reading Univ. (England). Dept. of Zoology.
S. F. Ham, D. A. Cooling, P. D. Hiley, P. R. McLeish, and H. R. A. Scorgie.
Freshwater Biology, Vol 12, No 1, p 1-15, February, 1982. 9 Fig, 2 Tab, 14 Ref.

Descriptors: *Macrophytes, *Population dynamics, Populations, Plant populations, Rivers, Ranunculus, Callitriche, Berula, Seasonal variation, *England, River Lambourn.

Macrophytes growing in a shaded section of a chalk stream were studied. A comparison was made with a similar study conducted on a nearby unshaded section of the River Lambourn. With the exception of Ranunculus spp, the changes in total cover did not indicate directly the pattern of growth and recession of the macrophytes. Analysis of gross changes, expressed as gains and losses in cover, indicated that colonization of gravel and silt by the dominant macrophyte, Berula erecta, did not vary seasonally. Colonization was at a constant rate of about 8% of the site each month throughout t he year and this accounted for 50% of the total number of gains by Berula. Gains of Berula from Ranunculus showed an annual cycle with a maximum during the summer when Ranunculus was in recession. Callitriche and Ranunculus both showed an annual pattern of growth and recession. There was temporal separation of the two macrophytes, with Ranunculus growing mainly in spring and early summer and Callitriche showing maximum growth in late summer and autumn, and some evidence of spatial separation. Discharge was thought to be an important variable controlling the growth of Ranunculus, since i ncrease in Ranunculus in the spring was positively correlated with the mean discharge at that time. In years when discharge was low, the growth of Ranunculus appeared restricted by shading from epiphytic algae which accumulated on the plant surfaces under these conditions. (Baker-FRC)
W83-00520

2J. Erosion and Sedimentation

CONTEMPORARY SEDIMENTARY ENVIRONMENTS ON BAFFIN ISLAND, N.W.T., CANADA: GLACIOMARINE PROCESSES IN FIORDS OF EASTERN CUMBERLAND PENINSULA,
Queen's Univ., Kingston (Ontario), Dept. of Geography.
R. Gilbert.
Arctic and Alpine Research, Vol 14, No 1, p 1-12, February, 1982. 7 Fig, 1 Tab, 37 Ref.

Descriptors: *Fiords, *Sedimentation, Sediments, *Baffin Island, Canada, Tidal effects, Aerolian deposits, Gravity flow, Flow, Sand, Silt, Clay, Turbidity, Coriolis force.

Observations were made in fiords on the east coast of Cumberland Peninsula, Baffin Island, to study to sedimentary processes at work there. Several processes were found, including the deposition of ice rafter sediments; the deposition from suspension in overflowing water; the deposition from mass movement including both subaqueous (turbidity currents, nonturbulent flow, slumping of oversteepened deposits on the side walls and sandur forest slopes) and subaerial (slides and falls on valley sides continuing down talus slopes beneath the water), and aeolian deposition. Patterns of current and suspended sediment deposition on the fiord floors are determined in part by the influence of Coriolis force. Despite a small tidal range the absence of sills within the fiords allows free exchange of sea water and frequent or quasi-continuous circulation at depth. Except near the head of the fiords in high energy environments of rapid sedimentation, bioturbation by molluscs and echinoderms destroys many of the fine sedimentary structures. These preliminary findings indicate the possibility of detailed modeling of sedimentary processes in arctic fiords through long term measurement of inflow and the flow regimes at the river mouths which are controlled by tidal patterns, of aeolian processes, of overflow patterns in distal regions, of subaqueous gravity processes, and of barotrophic circulation and exchange at depth. (Baker-FRC)
W83-00400

SHAPE AND DIMENSIONS OF STATIONARY DUNES IN RIVERS,
Technical Univ. of Denmark, Lyngby. Inst. of Hydrodynamics and Hydraulic Engineering.
J. Fredsoe.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 108, No HY8, p 932-947, August, 1982. 10 Fig, 22 Ref.

Descriptors: *Dunes, *Sediment transport, *River beds, Shear stress, Sand, Suspended load, Bed load, Flow resistance, Bed sediment.

The shape and dimensions of sand dunes in rivers were calculated by a mathematical model. Calculations were carried out in 2 steps: (1) the shape of the bed form that develops downstream a rearward-facing step, migrating with a velocity equal to that of the bed form and (2) the height of the bed form, obtained by a perturbation method. By distinguishing between bed load and suspended load it was possible to describe the transition from dunes to a plane bed as the dune height and dune steepness decreased at large bed shear stresses. Flow resistance curves in rivers were obtained by calculating the loss of expansion behind the dune crest by Carnot's formula. The results at low values of shear stress agreed well with those obtained in experiments. (Cassar-FRC)
W83-00451

SIMULATION OF NUTRIENT AND HEAVY METAL TRANSPORT CAPACITY OF SUSPENDED SEDIMENT,
Arizona Univ., Tucson. School of Renewable Natural Resources.
For primary bibliographic entry see Field 4D.
W83-00609

FROZEN SOIL EFFECTS ON THE EROSION HAZARD,
Idaho Univ., Moscow. Dept. of Agricultural Engineering.
E. S. Yen, and M. Molnau.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-125187, Price codes: A04 in paper copy, A01 in microfiche. Completion Report, Idaho Water and Energy Resources Research Institute, Idaho University, Moscow, April 1982. 66 p, 4 Fig, 15 Tab, 40 Ref. OWRT A-070-IDA(1).

Descriptors: *Erosion, *Sediment yield, *Frozen ground, *Seasonal variation, *Runoff, *Mathematical studies, Sedimentation, Erosion rates, Erosion control, Soil erosion, Evaluation, Freeze-thaw tests, Freezing, Ice formation, Runoff forecasting, Runoff rates, Snowmelt, Computer models, Model studies.

A study was conducted to ascertain whether erosion and sediment yield affected by frozen soil are usually worse than on unfrozen soil, and if erosion severity in early winter affected erosion severity in late winter or spring. Changes in surface roughness of three soil plots were determined as a function of freeze-thaw cycles. Runoff energy (RE) and sediment yield (SY) were classified relative to their occurrence on frozen, thawing, or unfrozen soil. Significant differences occurred in RE and SY from snowmelt or rainfall on frozen or unfrozen soil; SY from runoff on thawing/frozen soils was the same, and was significantly different from rain on unfrozen soil. Principal component and cluster analysis of RE, SY, and freeze index (FI) showed there is no statistical relation between RE, FI, or SY in the spring and winter, but that SY in winter is affected by RE, and that FI in winter with spring SY is determined by the spring RE. Further, random roughness on south-facing plots decreased to a base level faster than other aspect plots, but all plots approached the same base level roughness regardless of the orientation considered. The south-facing plot probably decreased faster because of increased frequently of freeze-thaw cycles. (Zielinski-MAXIMA)
W83-00615

2K. Chemical Processes

SELF-CONSISTENT LEAST-SQUARES METHOD OF ESTIMATING CHEMICAL COMPOSITION OF THE SOURCES OF CHEMICAL CONSTITUENTS IN NATURAL WATERS,
Tokyo Inst. of Tech. (Japan). Department of Environmental Chemistry.
M. Tsurumi.
Analytica Chimica Acta, Vol 138, p 177-182, 1982. 3 Tab, 7 Ref.

Descriptors: *Chemical composition, *Geochemistry, *Mixing, Saline water, Springs, Natural waters, Water analysis, *Least squares method, Mathematical studies.

The possible ranges of chemical composition of water sources in a mixed solution (for example, hot spring water, river water, and rain water) are estimated without prior assumption that all of a given element comes from one source. A conventional least squares calculation is applied, using a desktop computer, to identify the number and nature of the water sources and to quantitatively estimate the contribution of each source to the mixture. The example uses a mixture of water from 3 sources: saline water in an oil field, water with dissolved volcanic emission, and mineral spring water rich in Ca and bicarbonate. Constituents under consideration are Li, Na, K, Mg, Ca, Sr, Cl, bicarbonate, and sulfate. When it was presumed that 4 sources were present, the method showed that 2 were the same, for a total of 3 sources. Calculated results agreed with observed results within 10% for most of the elements and anions. (Cassar-FRC)
W83-00353

MELTWATER HYDROLOGY AND HYDROCHEMISTRY IN SNOW- AND ICE-COVERED MOUNTAIN CATCHMENTS,
Victoria Univ. of Manchester (England). Dept. of Geography.
For primary bibliographic entry see Field 2C.
W83-00377

THE EFFECT OF SALINE SEEPS AND RESTRICTED LIGHT UPON THE SEASONAL DYNAMICS OF PHYTOPLANKTON COMMUNITIES WITHIN A SOUTHWESTERN (USA) DESERT CANYON STREAM,
Northern Arizona Univ., Flagstaff. Dept. of Biological Sciences.
D. W. Blinn, M. Hurley, and L. Brokaw.
Archiv fur Hydrobiologie, Vol 92, No 3, p 287-305, October, 1981. 9 Fig, 1 Tab, 24 Ref.

Descriptors: *Saline water, *Phytoplankton, *Light penetration, Water pollution effects, Streams, Canyons, Chevelon Creek, *Arizona, Seasonal variation, Primary productivity, Productivity, Algae, Diatoms, Base flow, Arid lands, Water quality, Succession, Species distribution, Specific conductivity.

Phytoplankton communities were studied in Chevelon Creek, Arizona. This desert stream, which passes through long reaches of steepsided canyons, has large variations in ionic strength in space and time and limited light in some reaches. Saline water seeps from the canyon walls, and flows vary from 1 to 25,300 cu ft per sec. High specific conductance, 3600 micromhos per cm, is maintained from May to December, when winter storms increase runoff and dilute the saline water. Phytoplankton densities are very low, less than 200 cells per liter in winter, with a gradual increase to a maximum of 16,000 to 20,000 cells per liter in August and September. Bacillariophyta and Cyanophyta are the predominant algal groups. Diatoms are the most abundant phytoplankton, except in August and September. Seasonal succession of species corresponding with the ionic concentration occurs during base flow. The succession starts with Thalassiosira pseudonana in early May, when the specific conductance is $>$ 1.0 mmhos per cm. It is replaced by Chaetoceros muelleri when the specific conductance reaches $>$ 2.0 mmhos per cm. Rhizosolenia minima is dominant from the beginning of September until the end of October. Net primary production of phytoplankton is 2-3 times lower in the shaded section of the canyon than in the open sites. (Cassar-FRC)
W83-00398

CATION-EXCHANGE BEHAVIOUR OF A RANGE OF ADSORBENTS AND CHROMATOGRAPHIC SUPPORTS WITH REGARD TO THEIR SUITABILITY FOR INVESTIGATING TRACE METAL S PECIATION IN NATURAL WATERS,
Commonwealth Scientific and Industrial Research Organization, Cronulla (Australia). Div. of Fisheries and Oceanography.
For primary bibliographic entry see Field 5A.
W83-00517

LOW FLOW WATER CHEMISTRY IN FORESTED AND PASTURE CATCHMENTS, MAWHERAITI RIVER, WESTLAND,
Forest Research Inst., Christchurch (New Zealand).
For primary bibliographic entry see Field 5B.
W83-00568

THE DENSITY AND COMPOSITION OF HYPERSALINE WATERS OF A MEXICAN LAGOON,
Mexico Univ., Mexico City.
H. Fernendez, F. Vazquez, and F. J. Millero.
Limnology and Oceanography, Vol 27, No 2, p 315-321, 1982. 6 Fig, 2 Tab, 24 Ref.

Descriptors: *Chemical composition, *Saline water, *Density, *Evaporation, Lagoons, Coastal lagoons, Calcium, Sulfates, Chlorides, Sodium, Potassium, Magnesium, Bromides, Bicarbonates, Salinity, Chemical precipitation, Shallow water, Apozahualco, *Mexico.

The density and chemical composition of Apozahualco, a Mexican coastal lagoon, was measured over an 8 month period. After the rainy season, the lagoon receives little fresh water runoff and is isolated from the sea by a sand bar. During this period evaporation increases salinity of the water from 44 to 186 o/oo. Above a salinity of 90 o/oo CaSO4 precipitation causes decreases in the ratios of Ca:Cl and SO4:Cl. The ratios of Cl to other major constituents, Na, K, Mg, and Br, were fairly constant over the entire evaporation period. The initial Ca:Cl and HCO3:Cl ratios were lower than average seawater values, probably a result of CaCO3 precipitation. The densities of lagoon waters were measured at 20, 25, 30, 35, and 45 C and fit an equation which relates the density of the saline water to the density of water and 3 temperature parameters. Relative densities of the lagoon waters calculated from the equation agreed reasonably well with measured values, which at 25 C ranged from 26.301 at 19.37 o/oo Cl (standard seawater) at 144.072 at 104.33 o/oo Cl. (Cassar-FRC)
W83-00572

ORGANIC MATTER AND THE SURFACE CHARGE OF SUSPENDED PARTICLES IN ESTUARINE WATERS,
Otago Univ., Dunedin (New Zealand). Dept. of Chemistry.
K. A. Hunter, and P. S. Liss.
Limnology and Oceanography, Vol 27, No 2, p 322-335, 1982. 8 Fig, 2 Tab, 50 Ref.

Descriptors: *Organic matter, *Suspended solids, *Surfactants, Estuaries, Electrophoresis, Ionic interference, Salinity, Calcium, Metal oxides, Adsorption, Flocculation, *United Kingdom.

The surface electrical charges on suspended matter in four United Kingdom estuaries were measured as a function of salinity, using the particle microelectrophoresis technique. Two types of behavior were observed. In the Conway and Beaulieu rivers, low in dissolved cations and Ca(++), electrophoretic mobility was negative at all salinities. It increased in value (units, sq m per sec per V) from -1.9 times 10 to the minus 8th power at 0 o/oo salinity to -0.75 times 10 to the minus 8th power at 33 o/oo salinity. In the Alde and Orwell, richer in Ca(++), the electrophoretic mobilities were less affected by salinity: -1.0 to -1.2 times 10 to the minus 8th power sq m per sec per V at 0 o/oo to -0.75 to 0.08 times 10 to the minus 8th power sq m per sec per V at 33 o/oo. No positively charged particles were present. In spite of the mixed nature of the organic matter in the water, the charge distribution was very uniform, indicating that adsorbed organic matter, metallic oxides, or both dominated the surface properties. Apparently differential flocculation of the different suspended minerals is suppressed in estuarine waters. Dissolved organic carbon and surfactants were in concentrations high enough to allow adsorption. Poorly diluted raw sewage was observed in some locations with high surfactant levels. There was no evidence that nonconservative removal of dissolved organic carbon or surfactants occurred. Results showed that laboratory studies of solid/solution reactions in estuarine systems are inappropriate unless the natural surface state of the suspended matter is reproduced. (Cassar-FRC)
W83-00573

2L. Estuaries

BENTHIC COMMUNITIES IN AN ESTUARY WITH PERIODIC DEOXYGENATION,
Commonwealth Scientific and Industrial Research Organization, Cronulla (Australia). Div. of Fisheries and Oceanography.
S. F. Rainer, and R. C. Fitzhardinge.
Australian Journal of Marine and Freshwater Research, Vol 32, No 2, p 227-243, 1981. 3 Fig, 7 Tab, 36 Ref.

Descriptors: *Benthic fauna, *Oxygen depletion, *Environmental effects, *Estuaries, *Dissolved oxygen, Mangrove swamps, Intertidal areas, Sand, Sediments, Invertebrates, Temperature, Salinity, Species diversity, Biomass, Cabbage Tree Basin, Port Hacking, *Australia, Sea grasses.

Species diversity and biomass of benthic fauna were measured in Cabbage Tree Basin, Port Hacking, south of Sydney, Australia. Although nutrient enrichment and pollution are minimal, extreme environmental conditions exist. Over the May 1977 to September 1978 sampling period, temperatures varied from 10.7 to 26.6C, salinity from 6.9 to 36.2 o/oo, and dissolved oxygen from 0 to 352 micro

mol per kg. Six sites were sampled: (1) the mangrove intertidal region, (2) sand overgrown with Zostera seagrass (0.2 m deep), (3) clean sand flat (0.3 m deep), (4) silty sloping sand with Posidonia seagrass (2m deep), (5) silty sloping sand with surface detritus (5 m deep), and (6) deep basin (7.5 m deep). A total of 163 species were collected: 49 at Site (1), 87 at Site (2), 54 at Site (3), 94 at Site (4), 49 at Site (5), and 11 at Site (6). Biomass wet weights (g per sq m) were: Site (1), 1300; Site (2), 1800; Site (3), 93; Site (4), 290; Site (5), 35; and Site (6), 1.6. There were 59 species of polychaetes, 47 of mollusks, 27 of crustaceans, and 30 miscellaneous. Species diversity and evenness showed a variety of patterns. Dissolved oxygen levels were a significant factor in limiting distribution of species; sediment differences or short-term fluctuations in water temperature or salinity were not. Site-related differences were more important than time-related differences. The mangrove, Zostera, and sand flat sites had distinct fauna. It was apparent that there was no simple relationship between environmental harshness and diversity and evenness when calculated from frequency or biomass. (Cassar-FRC)
W83-00407

INTERTIDAL COMMUNITY OFFSHORE FROM THE WERRIBEE SEWAGE-TREATMENT FARM: AN OPPORTUNISTIC INFAUNAL ASSEMBLAGE,
Interstate Electronics Corp., Anaheim, CA. Ocean Sciences Dept.
For primary bibliographic entry see Field 5C.
W83-00409

EXCRETION OF DISSOLVED ORGANIC PHOSPHORUS IN TROPICAL BRACKISH WATERS,
Institut National de la Recherche Agronomique, Thonon-les-Bains (France). Station d'Hydrobiologie Lacustre.
L. Lemasson, and J. Pages.
Estuarine, Coastal and Shelf Science, Vol 12, No 5, p 511-523, 1981. 6 Fig, 2 Tab, 41 Ref.

Descriptors: *Phosphorus, *Excretion, *Plankton, Lagoons, Brackish water, Tropical regions, Seston, Particulate matter, Phytoplankton, Ebrie Lagoon, *Ivory Coast, Organic compounds, Accumulation, Nutrient cycling.

The excretion of dissolved organic phosphorus by plankton populations was measured with P32 tracers in samples from Ebrie Lagoon, Ivory Coast, a tropical brackish lagoon, during the 1977 dry season when hydrologic conditions were very stable. The 5 km wide, 150 km long, shallow lagoon was divided into 6 areas for study. Mean dissolved organic phosphorus excretion was at least 8% of net P absorption and represented 1.7% per hour of the biomass. Only 28% of the biomass was involved in rapid cycling of P. The release of P was inversely proportional to the particulate carbon/particulate nitrogen ratio of the seston and the dissolved inorganic phosphorus concentration. (Cassar-FRC)
W83-00419

DYNAMICS OF MIXING IN ESTUARIES,
Darmouth Coll., Hanover, NH. Dept. of Earth Sciences.
C. B. Officer, and D. R. Lynch.
Estuarine, Coastal and Shelf Science, Vol 12, No 5, p 525-533, 1981. 3 Fig, 6 Ref.

Descriptors: *Mixing, *Salinity, *Estuaries, Model studies, Salt, Mathematical equations, Estuarine environment.

The one-dimensional advective-dispersive equation for a non-conservative substance (Loder and Reichard, 1980) was modified so that salinity replaces longitudinal distance as an independent variable. These simplified relationships were explored in several analytic solutions, illustrating the effects of temporal variation and loss terms in distortion of concentrate-salinity mixing curves. It was concluded that real-time data can be used in constructing concentrate-salinity mixing curves. A one-dimensional spatial variability is not applicable to cases in which depth or transverse variation are important. A general equation suitable for complex problems is given. Its use avoids the complications that often occur when the non-linear advection term is included. (Cassar-FRC)
W83-00420

A COMPARATIVE ANALYSIS OF THE C02 AND WATER VAPOR RESPONSES OF TWO SPARTINA SPECIES FROM GEORGIA COASTAL MARSHES,
Smithsonian Institution, Washington, DC. Office of Biological Conservation.
For primary bibliographic entry see Field 2I.
W83-00421

A NOTE ON THE RELOCATION OF MARSH DEBRIS DURING A STORM SURGE,
North Carolina University at Wilmington. Dept. of Biology.
C. T. Hackney, and T. D. Bishop.
Estuarine Coastal and Shelf Science, Vol 12, No 5, p 621-624, 1981. 1 Fig, 13 Ref.

Descriptors: Marshes, *Organic matter, *Storm surges, Hurricanes, *Salt marshes, *Spartina, *Juncus, Tidal effects, Storm tides, Detritus, *Marsh plants, Coastal marshes, St. Louis Bay, *Mississippi, Wrack.

On July 11, 1979, Hurricane Bob, a low level storm, removed 218,000 kg of unattached dead plant material from a 96 ha salt marsh study area, composed of 12% Spartina marsh and 88% Juncus marsh. Aerial photographs and ground truth data from the St. Louis Bay, Mississippi, site showed that 226,000 kg had been removed and 7700 kg redeposited as 1-15.7 m wide strips of wrack along bands of tall vegetation. Little or no attached, standing plant matter was removed. It was estimated that the exported debris represented 3.7 billion kJ of energy lost or 16.7% of the annual net primary productivity. (Cassar-FRC)
W83-00422

COASTAL ZONE DEVELOPMENT: MITIGATION, MARSH CREATION, AND DECISION-MAKING,
Stanford Univ., CA. Program in Human Biology.
For primary bibliographic entry see Field 6G.
W83-00430

DESORPTION OF RU106, CS134, CS137, CE144 AND AM241 FROM INTERTIDAL SEDIMENT CONTAMINATED BY NUCLEAR FUEL REPROCESSING EFFLUENTS,
JRC, Varese (Italy). Radiochemistry Div.
For primary bibliographic entry see Field 5B.
W83-00437

MICROBIAL METABOLISM OF ACETATE, PROPIONATE, AND BUTYRATE IN ANOXIC SEDIMENT FROM THE COLNE POINT SALTMARSH, ESSEX, U.K.,
Essex Univ., Colchester (England). Dept. of Biology.
M. T. Balba, and D. B. Nedwell.
Journal of General Microbiology, Vol 128, No 7, p 1415-1422, July, 1982. 3 Fig, 2 Tab, 14 Ref.

Descriptors: *Marshes, *Metabolism, *Fatty acids, *Bacteria, Estuaries, Salt marshes, Anaerobic conditions, Sediments, Acetic acid, Propionic acid, Butyric acid, Volatile acids, Organic acids, Organic compounds, Colne Point Saltmarsh, *United Kingdom.

The in situ metabolism of short chain fatty acids (acetate, propionate, and butyrate) was measured in anaerobic salt marsh sediments by a gas chromatograph/gas proportional counting procedure. Rates of fatty acid metabolism (in nmol per ml per hour) incubated at 6.5C were 4.80 for acetate, 0.30 for propionate, and 0.19 for butyrate. Corrected turnover constants were: acetate, 0.91 per hour; propionate, 0.64 per hour; and butyrate, 1.05 per hour. The rate of acetate turnover decreased rapidly with increasing depth of sediment and was negligible at 20 cm. Only 6% of the acetate was derived from propionate and 7.9% from butyrate. The majority was derived from other precursors, as yet unknown. Turnover of propionate and butyrate was totally inhibited by molybdate, suggesting that sulfate-reducing bacteria were the major group responsible for their metabolism. (Cassar-FRC)
W83-00519

OBSERVATIONS FROM MOORED CURRENT METERS IN SAN FRANCISCO BAY, 1978.
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 7B.
W83-00551

HIGH FREQUENCY ENDOGENOUS PERIODICITIES OF CHLOROPHYLL SYNTHESIS IN ESTUARINE PHYTOPLANKTON,
Institut National de la Recherche Scientifique, Sainte-Foy (Quebec). Centre de l'Energie.
J. C. Auclair, S. Demers, M. Frechette, L. Legendre, and C. L. Trump.
Limnology and Oceanography, Vol 27, No 2, p 348-352, 1982. 3 Fig, 1 Tab, 15 Ref.

Descriptors: *Chlorophyll, *Phytoplankton, *Tidal effects, Photosynthesis, Light intensity, Mixing, Estuaries, *St. Lawrence Estuary, Algae, Diatoms, *Quebec.

A natural phytoplankton population, collected April 25, 1979, 8 km off Rimouski, Quebec, in the St. Lawrence Estuary, and isolated in a 1200 liter tank, exhibited 6-hour periodicity in chlorophyll synthesis which coincided with the tides. Nutrients were not limiting. The dominant phytoplankter was the diatom Thalassiosira nordenskioldii. The tidal heights were correlated with the detrended chlorophyll time series. Results suggested that chlorophyll concentrations were greatest during periods of maximum current shear and turbulence. At this time, light was unpredictable and large internal chlorophyll pools were present. At slack water, when the light regime was more stable, lower chlorophyll concentrations were found. This evidence agreed with a model of light-shade adaptation (Falkowski, 1980) in which glutamate pools can be directed toward synthesis of a chlorophyll precursor (low light intensities) or toward glutamine synthesis (high light intensities). (Cassar-FRC)
W83-00570

THE DENSITY AND COMPOSITION OF HYPERSALINE WATERS OF A MEXICAN LAGOON,
Mexico Univ., Mexico City.
For primary bibliographic entry see Field 2K.
W83-00572

ORGANIC MATTER AND THE SURFACE CHARGE OF SUSPENDED PARTICLES IN ESTUARINE WATERS,
Otago Univ., Dunedin (New Zealand). Dept. of Chemistry.
For primary bibliographic entry see Field 2K.
W83-00573

PHYTOPLANKTON OF THE YENISEY BAY,
L. V. Il'yash, and T. I. Kol'tsova.
Hydrobiological Journal, Vol 17, No 3, p 1-6, 1981. 1 Fig, 1 Tab, 7 Ref.

Descriptors: *Phytoplankton, *Species diversity, *Biomass, Rivers, Bays, Deltas, Coastal waters, Arctic zone, Diatoms, Yenisey River, Kara Sea, *USSR, Species composition, Siberia, Euphotic zone.

Phytoplankton of the Yenisey River delta and bay in northern Siberia are characterized by large biomass (up to 20.8 g per cu m) and low species diversity (d= 1.2), a predominance of fresh water species (Asterionella and Melosira granulata), and a community with uniform distribution over depth with respect to species composition, biomass, and abundance. These conditions are a result of exten-

sive mixing of the water. In the Kara Sea, into which the Yenisey empties, most of the phytoplankton are found in the euphotic zone. Biomass is no greater than 7-8 g per sq m. Species diversity is greater because fresh water, brachish water, and marine species are present. In the coastal region further from the influence of the river water there is a community with great diversity (d= 2.5) and small biomass (< 2 g per cu m). (Cassar-FRC)
W83-00577

EFFECT OF VARIABILITY OF RIVER RUNOFF ON SEAWATER INTRUSION INTO RIVER MOUTHS,
Gidrometeorologicheskii Inst., Leningrad (USSR).
I. N. Rusin, and A. Z. Svyatskii.
Water Resources, Vol 8, No 4, p 398-401, July/August, 1981. 3 Fig, 6 Ref. Translated from Vodnye Resursy, No 4, p 103-107, July/August, 1981.

Descriptors: *Saline water intrusion, *Runoff, *River flow, Estuaries, River mouth, Seasonal variation, Numerical analysis, Model studies, Discharge hydrographs, *USSR, Ob Bay.

A numerical model, based on the Hansen-Rattray equations, was used to investigate seawater intrusion into river mouths. A major factor influencing the distance of intrusion was volume of river runoff and its annual distribution. Other factors considered were the channel dimensions, coefficients of friction for the bottom and the ice cover, flow velocity components, density of river water, and elevation above the sea surface. The Hansen-Rattray problem was modified to account for the unsteady state caused by variations of river runoff during the year. The calculated free surface slope was characterized by seaward flattening and agreed well with observed results. The vertical density distribution in the halocline zone agreed less satisfactorily with measured data. To determine the position of a salt water boundary at a given instant it was necessary to investigate its movement as affected by the volume of river runoff during a certain preceding time interval, 3-4 years. (Cassar-FRC)
W83-00673

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

MAKING SALT WATER DRINKABLE,
M. C. Holliman.
Current Municipal Problems, Vol 7, No 3, p 460-464, 1981.

Descriptors: *Desalination, *Education, *Scientific personnel, Personnel, Training, Water supply, Water demand, Water shortage, Water resources development.

Fairleigh Dickinson University in New Jersey is now offering a Bachelor of Science degree in desalination of salt water. Such an education program should prove most helpful as the supplies of fresh water keep shrinking and the need for effective and efficient desalination methods increases. One semester of the four year degree program is spent at the West Indies Lab on the Island of St. Croix where students usually work in the lab's desalination facility or at other desalination plants owned by the Virgin Islands' Water and Power Authority and by various companies and hotels. Besides the new plants and desalination facilities that will have to be built in the next few years, there is a need for trained engineers and maintenance personnel immediately, especially in the less technologically advanced areas of the world, many of which are the areas most in need of fresh water. Many way are available for desalination of water including evaporation and condensation, multistage flash distillation, vapor compression distillation, vertical tube evaporation, and reverse osmosis. (Baker-FRC)
W83-00438

REVERSE OSMOSIS IN AN UNSTIRRED BATCH SYSTEM. II. ANALYSIS ON TRANSPORT PHENOMENA ACROSS MEMBRANE,
National Taiwan Univ., Taipei. Dept. of Chemical Engineering.
C.-C. Lin, and G.-J. Tsai.
Separation Science and Technology, Vol 17, No 6, p 839-848, 1982. 10 Fig, 6 Ref.

Descriptors: *Desalination, *Salt rejection, *Reverse osmosis, Simulation analysis, Model studies, *Membrane processes.

A mathematical model developed in a previous paper was used to simulate transport behavior across a membrane in a reverse osmosis unstirred batch system. The model was based on a two-parameter membrane transport mechanism and a salt differential equation. Results of the simulation increased the understanding of the effects of the concentration polarization phenomenon on the throughput rate and on percent salt rejection. Concentration polarization is defined as the buildup of excessive salts adjacent to the membrane. This decreases the driving force of solvent permeation with time. The constants characterizing desalination performance of a membrane were easily obtained by using experimental data with the model. (Cassar-FRC)
W83-00583

DESALTING SEAWATER AND BRACKISH WATERS: 1981 COST UPDATE,
Oak Ridge National Lab., TN.
S. A. Reed.
Available from the National Technical Information Service, Springfield, VA 22161 as DE82-020482, Price codes: A04 in paper copy, A01 in microfiche. Report ORNL/TM-8191, August 1982. 59 p, 12 Fig, 15 Tab, 4 Ref, 2 Append. W-7405-Eng-26.

Descriptors: *Desalination, *Brackish water, *Seawater, *Costs, Electrodialysis, Reverse osmosis, Distillation, Energy Costs.

This is the fourth in a series of desalting cost update reports. Product water costs are estimated based upon second quarter 1981 installed equipment costs, a level fixed charge rate, and energy and site development costs which are current. Cost data are reported for desalting seawater by various distillation systems and by reverse osmosis. Costs of desalting four brackish waters, representative of those found in the US by both reverse osmosis and electrodialysis are also given. Cost data are presented parametrically as a function of energy cost and plant size. The cost of desalting seawater by distillation has increased by 40% during the past two years, while desalting by reverse osmosis has increased during the same period by about 36%. Brackish water desalting by reverse osmosis has only increased by about 12%, and brackish water desalting by electrodialysis is up by 40%. The continued increase in energy costs has had a major impact on all desalination systems. (Moore-SRC)
W83-00642

3B. Water Yield Improvement

EFFECTS OF 2,4-D ON NON-TARGET SPECIES IN KERR RESERVOIR,
Oral Roberts Univ., Tulsa, OK. Dept. of Natural Science.
R. W. Couch, and E. N. Nelson.
Journal of Aquatic Plant Management, Vol 20, p 8-13, January, 1982. 6 Fig, 1 Tab, 16 Ref.

Descriptors: *Aquatic weed control, *Pesticide toxicity, *Aquatic plants, Phytoplankton, Zooplankton, *Herbicides, Aquatic weeds, Weed control, Benthic flora, Macroinvertebrates, Macrophytes, Plant populations, Aquatic populations, Reservoirs, Surface water, *Kerr Reservoir, *Oklahoma, *2,4-D.

Although the herbicide 2,4-dichlorophenoxyacetic acid (2,4-D) has been used for the effective control of many aquatic weeds, including Eurasian watermilfoil (Myriophyllum spicatum L.), since the mid 1940s, its effects on non-target organisms in the aquatic environment have not been studied extensively. This investigation studied the effects of 2,4-D treatment upon phytoplankton, zooplankton, benthic macroinvertebrate, and vascular macrophyte populations in Kerr Reservoir. The herbicide was applied to the Eurasian watermilfoil in the Reservoir at the label-recommended rates, not to exceed a concentration of 2 parts per million in the water. Eurasian watermilfoil control was estimated to be 75% each of the 2 years. The only detrimental effect to non-target species that could be attributed to herbicide treatment was a short term depression of phytoplankton populations in those sites sampled in 1977 where large areas of the reservoir were treated or when the treated areas were in places sheltered from the action of currents and waves. The zooplankton and benthic macroinvertebrate populations increased throughout the summer, with observed variations attributable to normal, seasonal environmental influences. The only non-target macrophytedamage observed either year was the er adication of a 1.0 hectare population of American lotus. It is concluded that 2,4-D did not adversely affect the non-target components in the ecosystems of the Kerr Reservoir. (Carroll-FRC)
W83-00378

THE USE OF HERBICIDES FOR AQUATIC WEED CONTROL IN WATER SUPPLY CATCHMENTS,
Severn-Trent Water Authority (England).
J. M. Hellawell, and K. A. Bryan.
Journal of the Institution of Water Engineers and Scientists, Vol 36, No 3, p 221-233, May, 1982. 1 Fig, 5 Tab, 11 Ref.

Descriptors: *Herbicides, *Aquatic weeds, *Weed control, Water pollution prevention, Aquatic weed control, Safety, Water supply.

The use of herbicides for aquatic weed control is reviewed with attention to official safety clearance procedures, formal approval of efficacy, and guidance for selection. The available herbicides cleared for use in or near water by the Pesticides Safety Precautions Scheme are asulam, chlorthiamid, 2,4-D amine, dalapon, dichlobenil, diquat, fosamine ammonium, glyphosate, maleic hydrazide, and terbutryne. Paraquat and chlorpropham are approved but not presently formulated for aquatic use. Herbicides are most likely to enter the water supply through accidental spills or careless disposal of herbicide containers. Whenever possible, the water authority also uses aquatic-approved herbicides for terrestrial uses. Guidelines for use of aquatic herbicides include: consider non-chemical methods; avoid purely cosmetic weed treatments; and consult with abstractors, riparian owners, and wildlife officials before use. The actual choice of an herbicide is aided by a flow chart which concerns location of weeds in the water course, submergence or non-submergence, season of operation, and type of vegetation to control. A table lists the type of herbicide, plants controlled and not controlled, application time, concentration, safety considerations, and restrictions of the 10 herbicides. The most effective herbicide for each of 54 weeds is given. Herbicides should be used according to manufacturer's directions, first on a small practice area. Concentrates must be mixed at a safe distance from the water's edge. Total weed control is rarely desirable; 75-80% removal is a better goal. (Cassar-FRC)
W83-00496

EVAPOTRANSPIRATION FROM RIPARIAN VEGETATION: WATER RELATIONS AND IRRECOVERABLE LOSSES FOR SALTCEDAR,
California Univ., Davis. Dept. of Land, Air and Water Resources.
D. C. Davenport, P. E. Martin, and R. M. Hagan.
Journal of Soil and Water Conservation, Vol 37, No 4, p 233-236, July-August, 1982. 3 Fig, 2 Tab, 11 Ref.

Descriptors: *Evapotranspiration, *Available water, *Antitranspirants, *Transpiration control, *Tamarisk, Soil water, Transpiration, Stomatal transpiration, Water loss, Evapotranspiration control, Soil-water-plant relationships, *Phreatophytes, California, New Mexico.

Data is presented on rates of irrecoverable evapotranspiration (ET) losses from saltcedar (Tamarix chinensis, Lour) and the variability in those rates due to density, soil water availability, and stomatal resistance. Another study reports on field trials to reduce transpiration by spraying saltcedar with a nontoxic antitranspirant. ET rates from saltcedar varied with weather factors, stand density and water availability. In California, ET in July for a unit area of saltcedar in large drums ranged from 2 mm/day in sparse stands to 15 mm/day in dense stands. When the plants were subjected to stress brought on by low soil water availability and/or high evaporative demand, ET declined and diffusive resistance increased. In June, in a natural saltcedar stand in New Mexico, ET varied from 3 mm to 11 mm/day depending on plant density and weather conditions. When assessing irrecoverable ET losses, care must be taken in extrapolating experimental transpiration data. (Geiger-FRC)
W83-00663

EVAPOTRANSPIRATION FROM RIPARIAN VEGETATION: CONSERVING WATER BY REDUCING SALTCEDAR TRANSPIRATION,
California Univ., Davis. Dept. of Land, Air and Water Resources.
D. C. Davenport, P. E. Martin, and R. M. Hagan.
Journal of Soil and Water Conservation, Vol 37, No 4, p 237-239, July-August, 1982. 3 Fig, 2 Tab, 12 Ref.

Descriptors: *Transpiration control, *Evapotranspiration, *Tamarisk, *Antitranspirants, Water loss, Evapotranspiration control, Soil erosion, Transpiration, Trees, Stomatal transpiration, Available water, *Phreatophytes, *Folicote, Water conservation.

Evapotranspiration (ET) from phreatophytic saltcedar (Tamarix chinensis, Lour) may be reduced by spraying the plant with a non-toxic, wax-based antitranspirant such as Folicote. The antitranspirant does not eradicate the vegetation, thus decreasing soil erosion. In field tests, Folicote sprayed with a backpack mistblower reduced saltcedar ET by 20 to 35% initially and by 10% after one month. When Folicote was sprayed by helicopter, no ET reduction occurred because the large droplet size caused poor foliar adherence. An operational program for antitranspirant spraying on phreatophytes cannot be recommended due to the high cost, the need to improve aerial application techniques, and the need for further studies on the effects of antitranspirants on wildlife. As water becomes more scarce and costly in the future, antitranspirant spraying programs may become more economically feasible in preventing irrecoverable water losses. (Geiger-FRC)
W83-00664

3C. Use Of Water Of Impaired Quality

THE ECONOMICS OF MUNICIPAL WASTEWATER REUSE,
Pennsylvania State Univ., University Park.
For primary bibliographic entry see Field 6B.
W83-00465

SPRINKLER IRRIGATION ANSWERS CITY WASTE PROBLEM,
J. Olsonbaker.
Irrigation Journal, Vol 30, No 1, p 40, 48-49, January/February, 1980.

Descriptors: *Sprinkler irrigation, *Wastewater irrigation, *Wastewater lagoons, Irrigation, Cranbrook, *British Columbia, Alfalfa, Lagoons, Wastewater disposal, Water reuse, Land disposal.

Wastewater irrigation of 1100 acres of alfalfa, using center pivot sprinkler irrigation, has been successful in Cranbrook, British Columbia. Effluent from a 3-cell series lagoon system travels 5 miles downhill through a 22 inch pipe to a 2-pond system, which provides aeration and settling for about a year before the water is used. Storage capacity allows for heavy rains and winter shutdown from October 1 to May 30. The 24-hour operation requires only 3 or 4 persons for 1 shift. Runoff is recycled onto the crop. Harvested alfalfa has a 22% protein content compared with 17.1% for most alfalfa. Problems include runoff from the silty, loose soil and difficulty in finding well-qualified help. (Cassar-FRC)
W83-00574

SURVEY OF JOINT US - USSR EXPERIENCE IN EFFECTIVE USE OF SALINE IRRIGATED LANDS.
Report of the Joint Soviet-American Working Group on Water Resources, L.G. Balaev, Ed. All-Union Research Institute of Hydraulic Engineering and Land Reclamation of the USSR Ministry of Land Reclamation and Water Management, Moscow, 1981. 147 p, 17 Fig, 23 Tab.

Descriptors: *International commissions, *Saline water, *Irrigation practices, *Mathematical models, *Impaired water use, Saline soils, Leaching, Salt tolerance, Drainage water, Irrigation water, Wastewater irrigation, Irrigation effects, Irrigable land, Environmental control, Water quality, Algorithms, Mathematical studies.

Works of Soviet and American Scientists are presented concerning the problem of effectively using saline-irrigated lands. Attention is focused on activities in three general areas: leaching; water and salt considerations; and drainage water use and its environmental impact potential. Specifically, these areas address: the basis of generalized material recommendations on leaching technology on irrigated lands; methods of forecasting water and salt regimens in irrigated areas with drainage systems, with the development and description of algorithms for their calculation; and the use of drainage water for irrigation, and programs for forecasting drainage water quality composition with respect to the problem of environmental control. Proper selection and application of drainage and of leaching irrigation regimes taken together with a proper fertilizer system and other agricultural reclamation measures, contribute to highly efficient use of irrigated saline lands. Further, algorithms can be used to select drainage parameters through their analysis of water and salt regimes. Application of a predictive mathematical model to simulate the effect of saline irrigation on water quality in field conditions typifying irrigation development in the western U.S. is described. (Zielinski-MAXIMA)
W83-00606

LEGAL LIABILITY OF RECLAIMED WATER SYSTEM PROPRIETORS,
Brown and Caldwell, Pasadena, CA.
For primary bibliographic entry see Field 6E.
W83-00620

CHARACTERISTICS AND APPLICATION OF BIG SANDY RIVER, GLENWOOD SPRINGS, AND DOTSERO SPRINGS WATERS IN ENERGY DEVELOPMENT,
Bureau of Reclamation, Denver, CO.
R. J. Eisenhauer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-111310, Price codes: A03 in paper copy, A01 in microfiche. Bureau of Reclamation Report REC-ERC-82-12, July 1982. 31 p, 2 Fig, 5 Tab, 19 Ref, 4 Append.

Descriptors: *Saline waters, *Coal slurry pipelines, *Energy development, *Water reuse, *Cooling water, Aquifers, Colorado River, Resources development, Injection wells, Salt-gradient ponds, Solar energy.

There are three point sources that contribute a combined salt load of 344,700 metric tons per year to the Colorado River: Big Sandy River contributes 117,900, Glenwood Springs contribute 163,300, and Dotsero Springs contribute 63,500 metric tons per year. To meet the objective of finding methods for disposal of point source water or for reuse of the saline waters in energy development, a literature study was made and laboratory coal and water slurry tests were performed. Samples of water from BS (Big Sandy) River Wells, GS (Glenwood Springs), and DS (Dotsero Springs) were analyzed for major cations and anions, trace metals, calcium sulfate solubility, total organic carbon, pH, and conductivity. BS, and DS waters could be taken from their aquifers, passed through filters, and used without further processing as transport media in coal slurry pipelines. Any of the three waters can be deep well injected after recovery by dewatering of coal slurries. Chemical characteristics of recovered BS water make it a promising candidate for use as a secondary coolant in binary cooling towers. The GS and DS waters are good candidates for use in solar salt-gradient ponds because of high concentrations of sodium chloride. Owing to the high cost of chemical treatment and desalination, present use of BS, GS, and DS waters for irrigation is not an acceptable option. (Moore-SRC)
W83-00639

EFFECT OF LIQUID WASTEWATER SLUDGE APPLICATION ON CROP YIELD AND WATER QUALITY,
Science and Education Administration, St. Paul, MN.
For primary bibliographic entry see Field 5E.
W83-00656

3E. Conservation In Industry

NEW EVAPORATION PROCESS: KEY TO ZERO DISCHARGE FOR ELECTROPLATERS.
For primary bibliographic entry see Field 5D.
W83-00417

3F. Conservation In Agriculture

DEVELOPMENT PROCESS FOR IMPROVING IRRIGATION WATER MANAGEMENT,
Colorado State Univ., Fort Collins. Dept. of Agricultural Engineering.
G. V. Skogerboe, M. K. Lowdermilk, E. W. Sparling, and J. E. Hautaluoma.
Water Supply and Management, Vol 6, No 4, p 329-342, 1982. 3 Fig, 1 Tab, 4 Ref.

Descriptors: *Irrigation programs, *Water management, *Project planning, Planning, Public participation, Decision making, *Developing countries, Interdisciplinary studies, Farm management, Alternative planning, Water resources development.

A development process for improving irrigation water management features an interdisciplinary approach and a farmer-client involvement. The main purposes, designed to ensure the long-term viability of the system, are increasing the production of existing irrigated lands, improving the equity of income distribution, and conserving water resources. The system, especially intended for developing countries, involves 3 phases: (1) problem identification, (2) solution development, and (3) project implementation. The interdisciplinary team includes physical and social scientists. Effective communication among the disciplines and farmers is emphasized. Special focus is given to listening to farmers' needs and perception of the major farm constraints, since they have extensive relevant information and intuitive understanding. Each of the above 3 phases is subdivided and illustrated by flow charts. Problem identification is broken down into reconnaissance and problem diagnosis, each with 5 steps. Development of solutions consists of identifying plausible solutions, testing and adapting solutions, and assessing solution packages. Project implementation involves authorization, organization, and operation, each divided into 5 or more subheadings. (Cassar-FRC)
W83-00458

AGRICULTURE,
California Univ., Davis.
B. D. Gardner, R. H. Coppock, C. D. Lynn, D. W. Rains, and R. S. Loomis.
In: Competition for California Water, Alternative Resolutions, Engelbert, E., ed., University of Cali-

fornia Press, Berkeley, 1982. p 11-36, 5 Tab, 21 Ref.

Descriptors: *Agriculture, *Crop production, *Farming, *Water costs, *Water use, *Irrigation, Consumptive use, Irrigation efficiency, Cropland, Crop yield, Climates, Soil types, Evapotranspiration, Elasticity of demand, Overdraft, Water reuse.

California is approaching the limits of its developed water supply and in some area groundwater overdraft exceeds replenishment. Agriculture consumptively uses about 85% of the developed supply to irrigate 8 million of the 11 million acres now producing crops. The overall efficiency of agricultural water use is closely tied to units of crop produced per unit of water applied. The amounts of water used are affected by differences in growing season and period, evapotranspiration (ET), cost and irrigation method. Sprinkler system efficiencies range from 75-85%, and drip efficiences may be higher. Water prices range from $1 per acre-foot to as much as $150 in drier regions of the state. Many districts use fixed per-acre charges instead of variable per-acre rates so they will be able to meet debt and overhead costs, and to be able to distribute all the surface water to which they have rights. Critics complain that irrigated agriculture wastes water; however, much of the unused water is recovered, returned to the system, and used again. There are nonrecoverable losses (22 million acre-feet/year) mostly through ET, which cannot be reduced without a concomitant reduction in crop biomass. To reduce on-farm water losses, farmers can adopt new irrigating technologies, cut applications below plant need, change cropping patterns, or stop irrigating some cropland. There are three alternative futures for California agriculture: status quo, which would increase costs but not necessarily make more water available for other uses; marketlike systems for water transfer; and development of new supplies, which is strongly favored by agriculture. (Atkins-Omniplan)
W83-00540

DRIP VS. FLOOD--VITICULTURE RESEARCH: A COMPARISON OF TWO IRRIGATION SYSTEMS IN CALIFORNIA VINEYARDS,
California State Univ., Fresno. Dept. of Viticulture.
V. E. Petrucci.
Irrigation Journal, Vol 30, No 3, p 22-25, May/June, 1980. 2 Tab.

Descriptors: *Irrigation effects, *Irrigation efficiency, *Grapes, *Drip irrigation, Raisins, *California, Fruit crops, Vine crops, Crop yield.

A drip irrigated Thompson seedless grape plot produced 38% more pounds of raisins with 40% less water applied over a 5-year study than a similar flat flood irrigated plot. In most of the years the fruit quality (sugar, acid, pH) and cluster counts were similar in both plots, but the drip irrigated plot averaged more clusters per vine. Raisins of Grade B or better averaged 78.1% in the drip plot and 86.1% in the flood plot. The percentages of final raisins, midgets, and trash were similar for both treatments. (Cassar-FRC)
W83-00588

COMPOSITE PERFORMANCE CHARTS FOR DRIP IRRIGATION TUBING,
Hundtoft (Elgin B.), Inc., Honolulu, HI.
E. B. Hundtoft.
Irrigation Journal, Vol 30, No 3, p 30-31, 34, 39, May/June, 1980. 9 Fig.

Descriptors: *Irrigation design, *Design criteria, *Performance evaluation, *Drip irrigation, Uniformity coefficient, Pressure distribution, Graphical analysis, Flow pattern, Irrigation practices.

Composite performance charts are presented to aid in design of drip irrigation systems. The well-defined behavior relationships between select design and performance (all straight lines) are illustrated in a graph that includes operating pressure, end pressure, Christensen's coefficient of uniformity, average orifice flow rate, and field slope. Using these charts makes it possible to quickly find if maximum hydraulic pressures exceed manufacturer's recommendations, locate areas of the design system which are off-limit, select the most suitable tubing, and minimize costs. The charts eliminate subjective visual judgments and misleading information from flow distribution profiles made with inappropriate units or coordinate scales. (Cassar-FRC)
W83-00589

WASTING WATER,
B. Camenga.
Irrigation Journal, Vol 31, No 3, p 22-23,25,26, July/August, 1981.

Descriptors: *Irrigation efficiency, *Landscaping, *Sprinklers, Lawns, Turf, Irrigation design, Irrigation operation, Maintenance, Water conservation, Nozzles.

Irrigation inefficiency originates in design of the system, installation of the system, or use and maintenance of the system. In times of water shortage landscape watering is often targeted for reduction, partly because waste in this application is so obvious. Use and maintenance problems should be corrected. This involves repairing, cleaning, or replacing defective or missing parts (sprinkler heads and risers, nozzles, pipes, valves, controllers, and fittings) with equipment of equal or better efficiency. An efficient watering schedule should be adopted. Proper design of the system reduces the chaces of operation in wind or after soil is sufficiently wet. Equipment modifications are available for watering slopes and locations subject to foot or vehicular traffic. (Cassar-FRC)
W83-00590

DRIP TESTED ON FLORIDA ORNAMENTALS, EVALUATION OF DRIP IRRIGATION FOR CONTAINER PRODUCTION OF WOODY LANDSCAPE PLANTS,
Agricultural Research Center, Monticello, FL.
D. M. Weatherspoon, and C. C. Harrell.
Irrigation Journal, Vol 31, No 3, p 22-23, May/June, 1981. 3 Tab.

Descriptors: *Irrigation efficiency, *Drip irrigation, *Ornamentals, *Florida, Irrigation practices, Water demand, Water use.

Irrigation efficiencies were 44-80% for drip irrigation and 13-26% for sprinklers used on container-grown woody landscape plants grown in Florida. Two experiments were run. The 1976 experiment used Leader tubes, Micro-drippers, Twin-wall hose, Viaflo tubing, and Rain Bird sprinklers. The 1977 experiment used Leader tubes, Micro-drippers, Vortex emitters, Viaflo tubing, and Roberts sprinklers. Plants were ligustrum, holly, azalea, and juniper. Growth indexes were comparable under all irrigation systems. However, a slight growth suppression, as indicated by visual root ratings, was seen in azaleas and hollies. The most practical drip systems for containers were Micro-drippers and Votex emitters. Drip systems are most practical with wide spacing and large containers. (Cassar-FRC)
W83-00591

IRRIGATION IN AMERICA-TODAY AND TOMORROW,
Water Management Irrigation Association, Beltsville, MD.
M. E. Jensen.
Irrigation Journal, Vol 31, No 4, p 28-29, 33,40, July/August, 1981. 1 Fig, 2 Tab.

Descriptors: *Irrigation, *Cropland, *Sprinkler irrigation, Energy, Trickle irrigation, Drip irrigation, Control systems, Automation, Basin irrigation, Surface irrigation.

Recent developments in U.S. irrigation technology are summarized. Total irrigated acreage has increased from 7.3 million ha in 1939 to 24.7 million ha in 1979. From 1974 to 1979 the largest increases in total area of irrigated cropland have been in the semiarid central and southern Great Plains. The subhumid cornbelt had the largest percentage increases (84%) in irrigated cropland. Sprinklers are featured in systems irrigating 30% of U.S. cropland. Center pivot systems have increased in popularity, hand-move systems have decreased, and side roll systems have remained stable, except for decreases in the cornbelt. Trickle or drop systems have increased by 50% from 1976 to 1979 to a 1979 total of 1% of total irrigated land. Sprinklers have increased partly because of improvements in technology. Irrigation in general has expanded as a result of sustained droughts and good water availability in some areas. Escalating energy costs are expected to slow the expansion of irrigation and promote conversion to low pressure sprinkler systems. New technology features level basin irrigation, automation of surface irrigation systems, and reuse systems. New developments in sprinkler irrigation include linear-move laterals and electronic control systems. In trickle or drip irrigation the micro-tubing emitters have been replaced with compact emitters. Plugging is still a major problem. (Cassar-FRC)
W83-00592

OPTIMAL PLANNING OF IRRIGATION DISTRIBUTION AND APPLICATION SYSTEMS FOR A LARGE IRRIGATED AREA,
Idaho Univ., Moscow. Coll. of Engineering.
K. H. Yoo, J. R. Busch, and C. E. Brockway.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-125195, Price codes: A12 in paper copy, A01 in microfiche. Completion Report, Idaho Water and Energy Resources Research Institute, Idaho University, Moscow, May 1982. 235 p, 24 Fig, 34 Tab, 39 Ref, 6 Append. OWRT B-041-IDA(5), 14-34-0001-8079.

Descriptors: *Optimum development plans, *Multiobjective planning, *Mathematical models, *Irrigation efficiency, *Econometrics, Systems analysis, Optimization, Planning, Irrigation practices, Economic aspects, Water costs, Water use efficiency, Irrigation water, Irrigation design, Irrigation districts, *Idaho, Sprinkler irrigation.

Techniques were developed and applied to a large irrigated area near Idaho Falls in an attempt to obtain optimal solutions for multi-objective planning of this area. The techniques were developed to effectively inventory the area, determine the costs and operating characteristics of irrigation system components, and to obtain optimal system plans using mathematical programming. The mathematical model procedures resulted in optimal irrigation system plans which were based on different specified constraints (e.g.: overall system efficiency; water delivery cost to the system at the headgate; water diversion cost from the distribution system to on-farm application systems). The results were used to determine costs and configurations needed to meet specified efficiency levels. When charging for water, water cost variation over a rather narrow range was effective in increasing overall efficiency to a point; additional charges had little effect. Consolidation plans for two irrigation districts in the study area revealed that it would be most economical to use a high pressure supply and sprinkler application system to attain an overall efficiency greater than 70%. The study results offer descriptive scenarios for assisting planners and irrigators in multiple objective planning decisions. (Zielinski-MAXIMA)
W83-00616

EFFECT OF LENGTH OF FALLOW PERIOD ON WATER STORAGE AND DRAINAGE,
Kansas State Univ., Manhattan. Dept. of Civil Engineering.
J. K. Koelliker, and F. R. Lamm.
Available from the National Technical Information Service, Springfield, VA 22161 as Price codes: A04 in paper copy, A01 in microfiche. Completion Report, Kansas Water Resources Research Institute, Kansas State University, Manhattan, August 1982. 50 p, 14 Fig, 6 Tab, 22 Ref, 2 Append. OWRT A-096-KAN(1), 14-34-0001-9018.

Descriptors: *Fallowing, *Water storage, *Controlled drainage, *Groundwater recharge, *Computer programs, Storage, Tillage, Drainage, Chis-

eling, Economic evaluation, Mathematical models, Simulation analysis, Hydrologic aspects, Hydrologic data, Soil water, Long-Term planning, Wheat, *Kansas.

Double fallowing involves the addition of another year to the 14-15 month fallow period between winter wheat crops. A field experiment was carried out to hydrobiologically evaluate the effect of tillage practices and the amount of residue at the beginning of fallow on the amount of water storage and drainage. Tillage practices minimizing the number of tillage operations (by use of chemicals for weed control and residue maintenance) provided the greatest water storage and drainage. Deep chiseling at the start of the fallow period added further to water storage and drainage. The ability of double fallow to cause drainage enhances groundwater recharge. The most efficient practice to promote drainage (chiseling plus chemical and no-till) was estimated to cause over 50 mm/year over the long term. Optimum increase in soil water content in the top 2 m was found to be about 250 mm. A limited economic analysis estimated the cost of water placed in the aquifer to be about $0.07/cu m ($85/acre-foot). Since the strata overlying the unconfined aquifer in the test area was generally dry, drainage would take 10 years or more to reach the saturated zone without a several-year practice of irrigation. Models are described for estimating double fallow capability by continuous computer simulation. (Zielinski-MAXIMA)
W83-00618

IMPROVEMENT OF IRRIGATION SCHEDULING TECHNIQUES FOR CORN WITH VARIABLE CORN MATURITY RANGE, PLANT POPULATION AND WATER SUPPLY AVAILABILITY,
Nebraska Univ.- Lincoln. Dept. of Agricultural Engineering.
D. G. Watts.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-125278, Price codes: A06 in paper copy, A01 in microfiche. Completion Report, Nebraska Water Resources Center, Nebraska University, Lincoln, June 1982. 110 p, 29 Fig, 7 Tab, 69 Ref, 6 Append. OWRT A-057-NEB(1), 14-34-0001-9029.

Descriptors: *Irrigation practices, *Corn, *Available water, *Crop yield, *Evapotranspiration potential, *Regression analysis, Water supply, Water use, Water demand, Irrigation efficiency, Lysimeters, Moisture meters, Alfalfa, Crop production, Evapotranspiration, Consumptive use, Mathematical studies, Field tests, *Irrigation scheduling, *Nebraska.

Research was carried out to develop improved crop coefficient (CC) functions to assist calculation of evapotranspiration (ET) in the scheduling of corn irrigation. Hydraulic lysimeters were installed and were seeded to three maturity ranges of corn, with four populations of each maturity during several growing seasons. The ratio of crop ET to potential ET (ETP) was calculated to estimate points on the CC function at different growth cycle stages. The ETP was computed by a modified Penman equation calibrated in the region. Comparison was made with ET by alfalfa planted in two lysimeters. The CCs were expressed as a function of accumulated growing degree days from planting, representing a significant procedural improvement since it describes the CC function increase equally well in cold, wet springs or during warm, dry ones. Plant population had no significant effect on ET levels. Partitioning of water use between evaporation and transpiration (T) was altered as populations increased, with more water use attributed to T. Maximum CC values appeared to be more closely related to the stage of growth of the crop than to the leaf area index of the crop. (Zielinski-MAXIMA)
W83-00624

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

GENERATION OF FECAL AND TOTAL COLIFORM SURGES BY STREAM FLOW MANIPULATION IN THE ABSENCE OF NORMAL HYDROMETEOROLOGICAL STIMULI,
Leeds Univ. (England). School of Geography.
For primary bibliographic entry see Field 5B.
W83-00385

PROTECTING STREAMFLOWS IN CALIFORNIA,
California Univ., Berkeley. School of Law.
For primary bibliographic entry see Field 6E.
W83-00425

TAMARISK AND RIVER-CHANNEL MANAGEMENT,
Arizona State Univ., Tempe. Dept. of Geography.
W. L. Graf.
Environmental Management, Vol 6, No 4, p 283-296, July, 1982. 14 Fig, 1 Tab, 35 Ref.

Descriptors: *Tamarisk, *Flood channels, *Groundwater levels, *Phreatophytes, Channel flow, Sedimentation, Flood control, Water table, *Salt River, *Gila River, *Arizona, Floods, Irrigation-return flow, Return water, Effluents, Plant growth, Soil-water-plant relationships, Trees, Dam effects, *Channel improvement.

Tamarisk (Tamarix chinensis Lour.), introduced into the southwest U.S. in 1856 and into the Salt and Gila Rivers, Arizona, about 1890, is widely distributed in flood control channels. Serious flooding has been caused by reduction of channel capacity. The distribution and density of tamarisk reached a peak in 1941 and since then have fluctuated in response to natural processes and human management. Groundwater level is the most significant factor controlling tamarisk growth. The plant begins to disappear when depth to water table exceeds 3-10 m. Water management practices (irrigation and sewage effluent seepage and well injections or withdrawals) that affect groundwater level indirectly influence tamarisk growth. Surface flows are not a major factor, except for spreading and germinating seeds. Floods uproot and destroy trees but also raise groundwater levels and provide water for seed germination. Wastewater effluent discharges and irrigation return water influence tamarisk growth only within a short distance from the input. Tamarisk is most successful in fine-grained silts and clays. Therefore, any condition promoting sediment deposition (low gradients, channel migration, dams) also encourages the tamarisk. Irrigation favors spread of tamarisk, whereas channel clearing reduces tamarisk area. (Cassar-FRC)
W83-00428

THE GANGES BASIN AND THE WATER DISPUTE,
Ministry of Power, Water Resources and Flood Control, Dacca (Bangladesh).
M. Zaman.
Water Supply and Management, Vol 6, No 4, p 321-328, 1982. 1 Fig, 2 Tab, 5 Ref.

Descriptors: *Water allocation, *International agreements, *Flow augmentation, Water rights, Water storage, Water shortage, Water resources development, Water conservation, Water control, Water conveyance, Water management, Water policy, Water transport, *Ganges River, *India, *Bangladesh, Nepal, Brahmaputra River, Hooghly River, Rivers, Irrigation, Canals, Dams, Diversion, Salinity, Treaties, Regulated flow, Regional planning, Snowmelt, Environmental effects.

The highly variable flow of the Ganges River and a barrage constructed by India at Farakka are causes of the 30-year water dispute between India and Bangladesh. Despite continuing negotiations, little progress in resolving differences was attained until the 1970's. Without official agreement India continued diversion up to full capacity of the feeder canal after a trial run in the spring of 1975. This created serious ecological problems in Bangladesh, especially in agriculture. Further negotiations under United Nations auspices produced the Ganges Waters Agreement, November 5, 1977. This established a quota schedule for each country and provided a long-term solution to the problem of augmentation of dry season flows in the river. Although both countries have followed the treaty provisions, a long-term solution has not yet been implemented. Augmentation schemes (irrigation storage dams upstream and on other rivers) have been prepared by India and Bangladesh, but neither country agrees with the other's proposals. Nepal, where storage dams may be located, has recognized the benefits of water resources development and management on a regional basis. These benefits include hydropower generation, flood control, irrigation, and river navigation. Until a permanent agreement can be reached, both sides can substantially reduce loss of water in irrigation systems by locating irrigation projects in proper soil types, improving irrigation practices, and optimizing a more efficient cropping program. (Cassar-FRC)
W83-00455

A STORMWATER MANAGEMENT MODEL FOR THE WEST BRANCH BRANDYWINE CREEK, CHESTER COUNTY, PENNSYLVANIA,
Geological Survey, Harrisburg, PA. Water Resources Div.
R. A. Sloto.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-204892, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 81-73, February 1982. 34 p, 8 Fig, 13 Tab, 16 Ref.

Descriptors: *Computer models, *Storm runoff, *Rainfall-runoff relationships, *Flood routing, Urbanization, Flood control, Forecasting, Flood peak, Flood-control storage, Water management, Model studies, Calibrations, Simulation analysis, Optimization, Soil water, Hydrographs, *Pennsylvania, Chester County, West Branch Brandywine Creek basin.

Three subbasins in the West Branch Brandywine Creek watershed were modeled by the Dawdy, Shaake, and Alley distributed-routing rainfall-runoff model. The model for the Honeybrook subbasin could not be calibrated because of nonrepresentative rainfall data. The Coatesville subbasin was calibrated, but not verified. The Modena subbasin was calibrated and verified. Predictive simulations were made using selected storms to examine the effects of projected population and four proposed flood-control structures in the Coatesville and Modena subbasins. Simulations of projected population growth in both subbasins showed that runoff volumes and peak discharges would have a greater percentage increase for low-magnitude floods than for high-magnitude floods. The effectiveness of any flood-control structure in the Coatesville subbasin depends upon the rainfall pattern in the West Branch Brandywine Creek basin and on whether or not it will be located upstream from a flood-control structure. In the Modena subbasin, the simulated effect of proposed flood-control structure PA-428 showed that it would lower the peak discharge of Sucker Run at State Route 82 and either raise or have no effect on peak discharge at West Branch Brandywine Creek at Modena. (USGS)
W83-00562

4B. Groundwater Management

BEYOND SECTION 858: A PROPOSED GROUND-WATER LIABILITY AND MANAGEMENT SYSTEM FOR THE EASTERN UNITED STATES,
National Energy Law and Policy Inst., OK.

For primary bibliographic entry see Field 6E.
W83-00439

EFFECT OF LENGTH OF FALLOW PERIOD ON WATER STORAGE AND DRAINAGE,
Kansas State Univ., Manhattan. Dept. of Civil Engineering.
For primary bibliographic entry see Field 3F.
W83-00618

ECONOMIC EVALUATION OF GROUNDWATER POLICY ALTERNATIVES IN THE NORTHERN GREAT PLAINS,
Nebraska Univ.-Lincoln. Dept. of Agricultural Economics.
R. J. Supalla.
Available from the National Technical Information Service, Springfield, VA 22161 as Price codes: A05 in paper copy, A01 in microfiche. Completion Report, Nebraska Water Resources Center, University of Nebraska, Lincoln, July 1982. 78 p, 25 Fig, 6 Tab, 20 Ref. OWRT B-045-NEB(2), 14-34-0001-8098.

Descriptors: *Groundwater management, *Economic evaluation, *Water use, *Water allocation, *Mathematical models, Economic prediction, Economic aspects, Economic impact, Aquifer systems, Aquifer management, Groundwater storage, Forecasting, Projections, Prediction, Consumptive use, Water demand, Farm management, Income, *Northern Great Plains, Nebraska.

Three groundwater management alternatives (unrestricted water use; a 10-inch allocation; and a 6-inch allocation) were evaluated for an area in south-central Nebraska typifying much of the Northern U.S. Plains. Assessment was made of the impact of each alternative on aquifer conditions, farm income, regional economic outputs, and employment, using analytic mathematical models. A 3-dimensional finite-element groundwater model determined aquifer impacts; a recursive, polyperiod linear program determined farm income effects; and an input-output model measured regional economic impacts. Restrictive groundwater pumpage regulations could significantly extend aquifer life with only minimal reductions in total net farm income. Such restrictions, however, would have very damaging impacts on the regional economy, including employment and population, for at least the next 40 years. The 6-inch allocation option was the most effective in terms of slowing aquifer depletion rates; as of the year 2020, it would reduce the level of aquifer exhaustion by 142,000 acres relative to the unrestricted case, and by 62,000 acres relative to the 10-inch allocation. However, by the same time, it would reduce full-time jobs by 1474 and total population by 3035 people. The unrestricted option offered the least economic impact. (Zielinski-MAXIMA)
W83-00623

4D. Watershed Protection

SIMULATION OF NUTRIENT AND HEAVY METAL TRANSPORT CAPACITY OF SUSPENDED SEDIMENT,
Arizona Univ., Tucson. School of Renewable Natural Resources.
W. A. Gabbert.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-125146, Price codes: A04 in paper copy, A01 in microfiche. M.S. Thesis, 1982. 49 p, 3 Fig, 9 Tab, 23 Ref, 2 Append. OWRT A-105-ARIZ.(1).

Descriptors: *Heavy metals, *Erosion, Sediments, *Sediment Transport, *Sediment yield, *Nutrients, Chemical elements (metal), Stream erosion, Sediment production, Sedimentation, Sediment concentration, Watershed Management, Water Quality, Arizona, New Mexico, *Computer models, *Simulation analysis, *Forested watersheds.

Transport of nutrients and heavy metals by suspended sediments has commonly been ignored in studies of stream export from small watersheds. A prototypical computer simulation model was developed to aid watershed managers and land use planners in estimating the impact of alternative land management practices on nutrient and heavy metal losses due to transported sediments on forested watersheds. Geology and vegetation of a watershed were used as predictors of chemical constituent concentrations in transported sediments. Predictive equations were developed using data collected in an earlier study, which found that differences exist in nutrient and heavy metal concentrations of sediments derived from various geologies and vegetation types. Combinations of vegetation types and geologies considered in this study include: ponderosa pine forests on soil parent material of basalt, sandstone, granite or limestone, and mixed conifer forests on basalt.
W83-00609

NONPOINT-SOURCE POLLUTION CONTROL: A RESOURCE CONSERVATION PERSPECTIVE,
Science and Education Administration, Tifton, GA. Southeast Watershed Research Center.
For primary bibliographic entry see Field 5G.
W83-00665

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

EXTRACTION-SPECTROPHOTOMETRIC DETERMINATION OF COPPER (II) WITH 4-(2-PYRIDYLAZO) RESORCINOL AND A LONG-CHAIN QUATERNARY AMMONIUM SALT,
Sofia Univ., Sofia (Bulgaria). Dept. of Analytical Chemistry.
D. Nonova, and K. Stoyanov.
Analytica Chimica Acta, Vol 138, p 321-328, 1982. 2 Fig, 6 Tab, 17 Ref.

Descriptors: *Copper, *Metals, *Wastewater analysis, *Pollutant identification, Heavy metals, *Spectrophotometry, Water analysis, Trace levels.

Trace levels of Cu(++) were determined in wastewater by extraction of its 4-(2-pyridylazo)-resorcinol complex in the presence of tetradecyldimethyl-benzylammonium chloride using chloroform and a borate buffer at pH 9.7. The absorbance of the Cu complex was determined at 510 nm by spectrophotometry. Beer's law was applicable over the range 0.1-0.5 micrograms Cu per ml. Sn(++), thiocyanate, iodide, and bromide interfered with the analysis. Other cations and anions either did not interfere or were easily masked. Applying the method to wastewater samples gave results comparable to those obtained with other methods. (Cassar-FRC)
W83-00354

SOLVENT EXTRACTION OF MOLYBDOPHOSPHATE WITH CATIONIC DYES AND SPECTROPHOTOMETRIC DETERMINATION OF MICRO AMOUNTS OF PHOSPHATE IN WATERS,
Okayama Univ. (Japan). Dept. of Chemistry.
S. Motomizu, T. Wakimoto, and K. Toei.
Analytica Chimica Acta, Vol 138, p 329-338, 1982. 6 Fig, 5 Tab, 19 Ref.

Descriptors: *Phosphates, *Pollutant identification, *Water analysis, Phosphorus, *Spectrophotometry, Trace levels, Ethyl violet, Dyes, Ammonium molybdate.

Phosphate in tap water was determined at the level of several ppb using a cationic dye (ethyl violet) and ammonium molybdate to form a colored complex, which was detected at 602 nm in a spectrophotometer. The extraction solvent was cyclohexane:4-methyl-pentan-2-one (1:3 v/v). Ethylenediaminetetrascetic acid was added to increase the stability of the ion-pair during shaking. Other dyes tested and found less satisfactory were crystal violet, p-rosaniline, brilliant green, iodine green, nile blue, Janus green B., rhodamines B and 6G, and methylene blue. In spiked river water and seawater samples, recoveries of P were 97-103% at levels of 9 to 54 micrograms per liter. Ten determinations on a tap water sample produced a mean value of 8.16 micrograms P per liter with standard deviation of 0.11% and relative standard deviation of 1.3%. The method detects orthophosphate and, after a hydrolysis procedure, condensed phosphate (pyro-, meta-, and poly-phosphate). For seawater samples a blank containing NaCl is necessary. As(5+), Sn(++), and Sn(4+) cause interference; silicates, vanadates, tungstates, and other common ions do not interfere. (Cassar-FRC)
W83-00355

INDIRECT DETERMINATION OF SUB-NG PER ML-1 LEVELS OF PHOSPHORUS IN WATERS BY DI-ISOBUTYL KETONE EXTRACTION OF REDUCED MOLYBDOANTIMONYLPHOSPHORIC ACID AND INDUCTIVELY-COUPLED PLASMA EMISSION SPECTROMETRY,
National Research Inst. for Pollution and Resources, Ibaraki (Japan).
A. Miyazaki, A. Kimura, and Y. Umezaki.
Analytica Chimica Acta, Vol 138, p 121-127, 1982. 3 Fig, 4 Tab, 9 Ref.

Descriptors: *Phosphorus, *Spectrometry, *Pollutant identification, Trace levels, *Water analysis, Emission spectroscopy, *Spectroscopy.

Phosphorus was indirectly determined at levels of 5.2 to 45 pg P per ml by extraction of the molybdoantimonylphosphoric acid derivative into diisobutyl ketone (DIBK) and measurement by inductively coupled plasma emission spectrophotometry at the Mo(++) 202.03 nm or Sb(+) 206.83 nm line. Relative standard deviations for 1 microgram P were 2.0% for the Mo measurement and 2.5% for the Sb measurement. The low solubility of DIBK in water made acid washing of the extract unnecessary. As(5+) interfered, but As(3+), Si, Ge, Fe(3+), and most anions did not. Recoveries of P added to artificial seawater in the P range of 0.05 to 5 micrograms were 96-102%. A series of 5 river water samples and 2 seawater samples analyzed by the method described in this paper agreed well with direct measurement of P. (Cassar-FRC)
W83-00380

RAPID SCREENING TECHNIQUE UTILISING HIGH-PERFORMANCE LIQUID CHROMATOGRAPHY FOR ASSESSING ACRYLAMIDE CONTAMINATION IN EFFLUENTS,
Plymouth Polytechnic (England). John Graymore Chemical Lab.
L. Brown, M. M. Rhead, and K. C. C. Bancroft.
Analyst, Vol 107, No 1276, p 749-754, July, 1982. 2 Fig, 22 Ref.

Descriptors: *Acrylamide, *Organic compounds, *Wastewater analysis, *Pollutant identification, Industrial wastewater, Water analysis, *Chromatography.

A rapid screening method for the determination of acrylamide in sewage and industrial effluents is described. Sample cleanup consists of passing the sample through a mixed-resin bed containing anionic, cationic, and hydrophobic resins. Reversed phase high-performance liquid chromatography with ultraviolet detection at 202 nm is used for quantitative determination. Analysis of spiked samples of river water, sewage effluent, and china clay works effluent demonstrated precisions of 10% at 5 and 10 micrograms per liter and 4% at 100 micrograms per liter acrylamide. (Cassar-FRC)
W83-00381

EXTRACTION AND ANALYSIS OF INTERSTITIAL WATER FROM SANDSTONE,
Severn-Trent Water Authority, Birmingham (England). Directorate of Scientific Services.
K. C. Wheatstone, and D. Gelsthorpe.
Analyst, Vol 107, No 1276, p 731-736, July, 1982. 3 Fig, 5 Tab, 3 Ref.

Descriptors: *Interstitial water, *Centrifugation, *Sandstone, Pollutant identification, Cores, Water analysis.

A routine laboratory technique for extracting interstitial water from borehole core samples of sandstone used a high speed centrifuge fitted with 6 titanium sample cups. Operating conditions were 12,000 revolutions per min, the maximum speed of the machine, for a half hour. Water volumes extracted were within + or - 10% of the average. No fractionation effects (changes in chemical composition depending on the amount removed) were observed. Samples were frozen for transfer to the laboratory to prevent water drainage and to preserve determinands such as nitrate and phosphate. (Cassar-FRC)
W83-00382

DETERMINATION OF SELECTED ORGANICS IN TREATED SLUDGES AND ASSOCIATED LEACHATES FROM COAL CONVERSION FACILITIES,
Oak Ridge National Lab., TN.
M. P. Maskarinec, R. S. Brazell, R. W. Harvey, and D. K. Brown.
Analytica Chimica Acta, Vol 139, p 257-266, 1982. 5 Fig, 3 Tab, 9 Ref.

Descriptors: *Organic compounds, *Coal gasification, *Solid wastes, Leachates, Pollutant identification, Extraction, Sludge, Fate of pollutants, Water pollution sources.

Analytical methods were developed for identifying and assessing mobility of organic compounds in coal conversion solid wastes. The 3 wastes were a final wastewater treatment plant sludge, a filtered biological treatment plant sludge, and centrifuged heavy oil residuals. A sequential extraction procedure used acid, base, and organic solvent (methylene chloride) as well as collection of volatile components. Three fractions were obtained: base, acid, and neutral. Each fraction was then chromatographed separately to identify a variety of compounds: polynuclear aromatics, phenols, aliphatic hydrocarbons, and many others. The volatile fraction contained alkylbenzenes and phenolic compounds. Sample extraction efficiency of this method was much greater than that of Soxhlet extraction. Mobility of water-soluble compounds in solid waste was compared using 5 extraction methods. The upward flow column method using distilled deionized water was more effective in extracting organic compounds than the other four procedures, all batch extractions. Of all the compounds leached from the solid wastes, phenolics emerged as the major concern. Others detected were 3-carbon substituted (trimethyl, methylethyl, and propyl) pyridines and phenols, naphthalene, quinoline, substituted naphthalenes, cresol, xylenol, naphthol, and biphenyl. (Cassar-FRC)
W83-00383

DILUENT COMPOSITION FOR USE OF API 20E IN CHARACTERIZING MARINE AND ESTUARINE BACTERIA,
University of West Florida, Pensacola. Dept. of Biology.
M. T. MacDonell, F. L. Singleton, and M. A. Hood.
Applied and Environmental Microbiology, Vol 44, No 2, p 423-427, August, 1982. 3 Tab, 22 Ref.

Descriptors: *Bacteria, *Saline water, *Pollutant identification, *Marine bacteria, API 20E, Estuarine bacteria, Salinity, Vibrio, Aeromonas, Allomonas, Photobacterium.

The influence of diluent composition on the biochemical profiles of 30 marine and estuarine bacteria was evaluated. The 9 diluents consisted of 3 groups: (1) NaCl solutions, 0.85, 2.0, and 3.5%; (2) marine salts at salinities of 8.5, 20, and 35 o/oo; and (3) combinations of 2 or 3 major cations (Na, K, and Mg) equivalent in concentrations encountered in 20 o/oo seawater. Organisms included Vibrio, Aeromonas, Allomonas, and Photobacterium. The diluent composed of 20 o/oo marine salts was significantly more effective than any other diluent. The API 20 E system using this diluent and an incubation temperature of 22C was recommended for rapid characterization of estuarine and marine bacteria. The 20 o/oo diluent identified halophilic strains usually unreactive by the APE 20E system, which normally uses the 0.85% NaCl solution as a diluent. In addition isolates identified as Vibrio parahaemolyticus by the clinical inoculation procedure were actually Vibrio vulnificus. (Cassar-FRC)
W83-00388

AMOEBAE FROM ANTARCTIC SOIL AND WATER,
Massey Univ., Palmerston North (New Zealand). Dept. of Microbiology and Genetics.
T. J. Brown, R. T. M. Cursons, and E. A. Keys.
Applied and Environmental Microbiology, Vol 44, No 2, p 491-493, August, 1982. 2 Tab, 13 Ref.

Descriptors: *Amoebae, *Pathogens, Streams, Glacial streams, Lakes, Rivers, *Antarctic, Water analysis, Acanthamoeba, Naegleria, Vahlkampfia, Hartmanella, Platyamoeba, McMurdo Sound, Cold regions.

Water and soil samples were collected at several locations in the region of McMurdo Sound and Dry Valley, Antarctica. Of the 70 samples taken, 22 contained amoebae capable of clonal growth at 30C. None of the amoebae were pathogenic to mice. Commonly found species were Acanthamoeba, Naegleria, Vahlkampfia, Hartmanella, and Platyamoeba. (Cassar-FRC)
W83-00389

MEASUREMENT OF AQUATIC BIODEGRADATION RATES BY DETERMINING HETEROTROPHIC UPTAKE OF RADIOLABELED POLLUTANTS,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
For primary bibliographic entry see Field 5B.
W83-00392

USE OF A HYDRIDE-GENERATION TECHNIQUE FOR THE ATOMIC ABSORPTION DETERMINATION OF LEAD IN DRINKING WATER,
National Inst. for Water Research, Pretoria (South Africa).
R. Smith.
Atomic Spectroscopy, Vol 2, No 5, p 155-158, 1981. 4 Fig, 2 Tab, 9 Ref.

Descriptors: *Water analysis, *Atomic absorption spectroscopy, *Lead, Metals, Drinking water, Potable water, Measuring instruments, *Pollutant identification, Hydride generation.

A method for the determination of lead in drinking water is presented. The method incorporates the use of potassium cyanide solution for the reduction of copper interference. For optimum results the pH of the sample solution should be controlled between 1.5 and 2.2. With this method analyses can be carried out which are particularly suitable for the determination of lead in drinking water. Lead at concentrations of about 5 micrograms per liter to 100 micrograms/liter is detectable. (Baker-FRC)
W83-00401

DETERMINATION OF ARSENIC IN SYNTHETIC FUEL PROCESS WATERS,
Perkin-Elmer Corp., Norwalk, CT.
D. C. Manning, R. D. Ediger, and D. W. Hoult.
Atomic Spectroscopy, Vol 1, No 3, p 52-54, 1980. 3 Tab, 22 Ref.

Descriptors: *Arsenic, *Water analysis, *Measuring instruments, Furnace atomic absorption, Inductively coupled plasma emission, *Atomic absorption spectroscopy, Oil shale, Shales, Oil industry, Industrial wastes, Wastewater, Coal gasification, *Pollutant identification.

Four different atomic spectroscopy methods were used to analyze three synthetic fuel process waters. The methods included furnace atomic absorption, inductively coupled plasma emission (ICP), arsine-generation atomic absorption and flame atomic absorption. The three samples were distributed to a number of labs as part of a collaborative study. One was a product water from oil-shale retorting by an aboveground process labeled 'A.G. Retort'. A second was a product water fromtrue in situ oil-shale retorting, I.S. Retort. The third was a product water from an in situ coal gasification experiment, Coal Gas. The results were in good-to-excellent agreement, indicating that any of the analytical methods would be satisfactory for this type of sample, at these concentration levels of arsenic (0.94 to 30 mg/liter). For lower concentration levels, the hydride method or the furnace method would be preferable, as they are more sensitive than the other methods. No sample preparation was needed for the flame or ICP work. Only dilution with the Ni(N03)2 stabilizer was needed for the graphite furnace. For hydride generation, a prior acid digestion was necessary. (Baker-FRC)
W83-00402

INFLUENCE OF VALENCE STATE ON THE DETERMINATION OF ANTIMONY, ARSENIC, BISMUTH, SELENIUM AND TELLURIUM IN LAKE WATER USING THE HYDRIDE AA TECHNIQUE,
Utilitarian Union Lake Constance Water Supply Suessenmuehle, Ueberlingen (Germany, F.R.).
H. W. Sinemus, M. Melcher, and B. Welz.
Atomic Spectroscopy, Vol 2, No 3, p 81-86, 1981. 9 Fig, 2 Tab, 10 Ref.

Descriptors: *Water analysis, *Atomic absorption spectroscopy, *Pollutant identification, Arsenic, Tellurium, Selenium, Antimony, Bismuth, Lakes, Natural water.

The hydride atomic absorption technique was used in the determination of Sb, As, Bi, Se, and Te in lake water. With this technique, lower peak-height sensitivities are found for the higher oxidation states of the group V elements. Bi(V) compounds are generally unstable and thus were not to be expected in natural waters. The oxidation state (VI) of the group VI elements Se and Te gives almost no measureable signal with the hydride AA technique. A prereduction was thus needed for the determination of these elements in natural waters. Due to the extreme sensitivity difference for the two oxidation state of Se and Te, a selective determination of the oxidation state (IV) becomes possible in addition to the total content of these two elements. (Baker-FRC)
W83-00403

DETERMINATION OF DISSOLVED SELENIUM IN FRESH AND ESTUARINE WATERS BY FLAMELESS ATOMIC ABSORPTION,
New York State Dept. of Health, Albany. Div. of Labs. and Research.
V. B. Stein, E. Canelli, and A. H. Richards.
Atomic Spectroscopy, Vol 1, No 3, p 61-65, 1980. 4 Fig, 3 Tab, 19 Ref.

Descriptors: *Water analysis, *Selenium, *Atomic absorption spectroscopy, Natural waters, Estuaries, *Pollutant identification, Metals.

A simplified, sensitive and rapid method for determing low concentrations of selenium in fresh and estuarine waters is described. To control acidity and avoid analyte coprecipitation, the pH of samples was adjusted to 3.0 + or - 0.1 with HN03. To enhance the selenium signal, all samples were fortified with 0.2% nickel, and to increase sensitivity while minimizing matrix interferences, freshwater samples were also fortified with 100 mg/l calcium. The sample or standard was injected into a heated graphite atomizer, and the specific atomic absorbance was measured. Analyte concentrations for fresh waters were calculated from the calibration curves for aqueous solutions, while those obtained for estuarine waters were from measurements of an artificial seawater medium. The analytical range was linear from 5.0 to 100 microg/liter, and the detection limit was 2.5 micrograms/liter in 50 microliter fresh or estuarine samples. In 20-microliter samples, the relative standard deviations at the 5- and 25 microgram/liter level were 22.0 and 2.1% for fresh waters and 29.0 and 4.8% for estuarine waters. A comparison of the method with standard additions showed a significant difference for 21 freshwater samples. However, there

was no significant difference for the 24 estuarine water samples tested. (Baker-FRC)
W83-00404

DETERMINATION OF ARSENIC IN POTABLE, FRESH AND ESTUARINE WATER BY FLAMELESS ATOMIC ABSORPTION,
New York State Dept. of Health, Albany. Div. of Labs. and Research.
V. B. Stein, E. Canelli, and A. H. Richards.
Atomic Spectroscopy, Vol 1, No 5, p 133-137, 1980. 4 Fig, 5 Tab, 16 Ref.

Descriptors: *Water analysis, *Arsenic, *Atomic absorption spectroscopy, Measuring instruments, Potable water, Drinking water, Natural waters, Estuaries, *Pollutant identification.

A precise, accurate and rapid method is proposed for the determination of dissolved arsenic in potable, fresh and estuarine waters. The sample is filtered, adjusted to pH 3.0 with nitric acid and fortified with 0.05% nickel. Potable water samples are also fortified with 100 mg/L calcium. The sample or standard is injected into a heated graphite atomizer, and the specific atomic absorbance is measured. Calibration is done with aqueous standards for potable waters and with arsenic-free saline for estuarine water samples. Twenty-six potable, 16 fresh and 28 estuarine water samples were analyzed for arsenic by the technique and by the method of standard additions. For the 10 microgram/liter spike the means and standard deviations were respectively: in potable water, 9.87 + or - 0.73 micrograms/liter and 9.94 + or - 0.65 micrograms/liter; in the estuarine water, 10.16 + or - 0.71 micrograms/liter and 9.90 + or - 0.76 micrograms/liter; in fresh water, 9.58 + or - 0.36 micrograms/liter and 9.71 + or - 0.49 micrograms/liter. The results for two carbonated water samples analyzed for arsenic by the proposed method were compared to those obtained by standard additions and the arsine-generation method. The concentrations determined by the proposed technique were within 10% of those determined by the other two methods. (Baker-FRC)
W83-00405

OBSERVATIONS ON NITRATE, PHOSPHATE AND SILICATE IN CLEVELAND BAY, NORTHERN QUEENSLAND,
James Cook University of North Queensland, Townsville (Australia). School of Biological Sciences.
T. A. Walker, and G. O'Donnell.
Australian Journal of Marine and Freshwater Research, Vol 32, No 6, p 877-887, 1981. 7 Fig, 2 Tab, 34 Ref.

Descriptors: *Nutrients, *Suspended sediments, *Lagoons, Nitrates, Phosphates, Silicates, Phytoplankton, Salinity, Cleveland Bay, *Australia, Wind-driven currents, Water currents, Sediments, Runoff, River flow, Great Barrier Reef.

Nitrate, phosphate, and silicate concentration were determined monthly from December 1976 to October 1977 in 9 rivers and creeks and in Cleveland Bay in the Townsville region, Australia. Rainfall during the study period was 1568 mm, above the average of 1130 mm. Levels of the 3 nutrients (all in microgram-atom per liter) in rivers were: nitrate, 0-30.2; phosphate, 0-3.32; and silicate, 14-310. Nitrate levels were high during flood runoff, nearly zero at low flow. Phosphate was at uniformly low concentration, except in 2 rivers. Silicate levels were high, fairly constant, with decreases occurring during floods. Runoff during the wet season enriched the water at the marine station poorly with phosphate, moderately with nitrate, and greatly with silicate. Nitrate and phosphate levels were weakly correlated with salinity but were strongly correlated with Secchi disc transparency, indicating that release of nitrate occurred via bottom sediment resuspension, generally produced by intermittent wind-driven events. Addition of nitrate stimulated phytoplankton growth; addition of nitrate and phosphate produced maximum growth. Silicate was not limiting. (Cassar-FRC)
W83-00406

METAL LEVELS IN THE MUSSEL MYTILUS EDULIS COLLECTED FROM ESTUARIES IN SOUTH-EASTERN AUSTRALIA,
New South Wales Univ., Kensington (Australia). School of Food Technology.
M. Wootton, and A. K. Lye.
Australian Journal of Marine and Freshwater Research, Vol 33, No 2, p363-367, 1982. 1 Tab, 10 Ref.

Descriptors: *Mussels, *Shellfish farming, *Metals, Mytilus edulis, *Australia, Estuaries, *Pollutant identification, Mollusks, Heavy metals, Lead, Copper, Chromium, Nickel, Cadmium, Zinc.

Metal levels in Mytilus edulis collected from 5 potential mussel culture sites on the southeast Australian coast showed that Batemans Bay, Lakes Entrance, and Merimbula were more suitable for mussel culture with respect to metals concentrations than Eden and Jervis Bay. Mussels from Eden and Jervis Bay contained the following metals concentrations (all in micrograms per g wet weight); 1.65-6.47 Pb, 2.40-4.91 Cu, 1.06-6.13 Cr, 1.64-5.41 Ni, 0.25-1.11 Cd, and 18.20-70.56 Zn. Only Pb levels exceeded national standards for metal in mollusks (2.5 micrograms per g Pb wet weight). In the less contaminated waters metal levels (in micrograms per g wet weight) in mussels were: 0.37-5.05 Pb, 1.03-3.43 Cu, 0.87-5.86 Cr, 0.99-4.91 Ni, 0.23-0.91 Cd, and 12.73-42.11 Zn. (Cassar-FRC)
W83-00411

TRACE METAL SPECIATION IN THREE VICTORIAN LAKES,
Caulfield Inst. of Tech. (Australia). Dept. of Chemistry.
B. T. Hart, and S. H. R. Davies.
Australian Journal of Marine and Freshwater Research, Vol 32, No 2, p 175-189, 1981. 3 Fig, 3 Tab, 41 Ref.

Descriptors: *Metals, *Lakes, *Speciation, Trace metals, Heavy metals, *Pollutant identification, *Australia, Cadmium, Copper, Iron, Lead, Zinc, Particulate matter, Chemical composition.

Trace metal species (Fe, Cd, Cu, Pb, and Zn) were investigated in 3 lakes in Victoria, Australia. Membrane filtration, Chelex resin, and dialysis were used to separate the metals into particulate, filterable, ion-exchangeable, dialyzable, and bound metal fractions. The 3 lakes were: Lake Tarli Karng, a small, closed deep landslide lake in a forested catchment; Targo Reservoir, located in a eucalypt forest, with stratification and high iron levels; and East Basin Lake, small, closed, and of volcanic origin. Total metal levels and distribution between particulate and filterable fractions varied considerably among the 3 lakes because they were quite different in water chemistry and hydrological properties. Most of the Cd, Cu, Pb, and Zn were in filterable forms, the largest amount of this in ion-exchangeable forms. The ion-exchangeable fraction consisted of free metal ions and simple organic and inorganic complexes. The bound fraction consisted of metal species associated with organic or inorganic colloids as stable or inert species. Iron was found mainly in bound form, usually as the iron hydroxyoxides in colloidal or particulate form. A table lists the values for total metal and each fraction for 2 sampling dates for each of the 3 lakes. Total metal levels were (in micrograms per liter): Cd, 0.1-0.78; Cu, 1.1-4.7; Fe, 150-950; Pb, 0.6-9.7; and Zn, 2.8-14.4. (Cassar-FRC)
W83-00412

BACTERIAL WATER QUALITY: SPRINGS AND STREAMS IN THE GREAT SMOKY MOUNTAINS NATIONAL PARK,
Great Smoky Mountains National Park, Gatlinburg, TN. Uplands Field Research Lab.
D. G. Silsbee, and G. L. Larson.
Environmental Management, Vol 6, No 4, p 353-359, July, 1982. 3 Fig, 4 Tab, 19 Ref.

Descriptors: Parks, *Bacteria, Water supply, *Water quality, Pollutant identification, Water pollution sources, Fate of pollutants, Great Smoky Mountains National Park, *Tennessee, *National parks, Recreation, Swimming, Drinking water, Springs, Streams, Wilderness areas, Coliforms.

Fecal coliforms, fecal streptococci, and total coliforms were determined in water samples from streams and springs in the Great Smoky Mountains National Park, Tennessee. Bacterial densities were significantly higher in summer and autumn than in winter and during and after heavy rain. Larger streams had the highest bacterial levels, which decreased in order of primary streams, seepage springs, and upwelling springs. Most samples exceeded the fecal coliform and total coliform levels specified for drinking water without treatment, but none exceeded Tennessee standards for body contact recreation. Only 1.4% of the samples had no detectable organisms; 80% had bacterial densities $>$ 100 per 100 ml total coliforms. Visitors did not appear to be the major direct contributors to bacterial contamination, as determined by samples taken upstream and downstream of camp sites, picnic grounds, and other visitor sites. Rather, it was believed that bacteria in the soil, leaf litter, and stream sediments from natural sources multiplied more rapidly in the warmer water temperatures of summer and autumn. As a result of these findings, water pipes at natural springs were removed by the park service, and communications to visitors now include instructions to purify all drinking water. (Cassar-FRC)
W83-00426

WATER QUALITY MONITORING: WHAT DIRECTIONS SHOULD NEW PROGRAMS TAKE,
Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering.
J. C. Loftis, R. C. Ward, and D. J. Schaeffer.
Environmental Management, Vol 6, No 4, p 279-282, July, 1982. 24 Ref.

Descriptors: *Sampling, *Monitoring, *Data collection, *Water quality standards, Pollutant identification, Water analysis, Network design, Regulations, STORET, Standards, Statistical analysis, Computers, Information systems.

Two responses to the U.S. General Accounting Office's report CED-81-30 are presented. This report criticized the current practices of routine, fixed-station monitoring for river and stream water quality and concluded that synoptic surveys or special studies should replace routine monitoring. The first defendants of the present system point out that routine monitoring, although imperfect, will continue to be an integral part of regulatory water quality monitoring. It is the simplest and least expensive means of checking compliance with a standard. Routine monitoring can be made more efficient, reliable, and economic by improving network design, data collection, and data utilization. The statistical approach to water quality monitoring is receiving increasing attention. The second comment emphasizes the effective use of data in regulatory water quality monitoring. In the past 5 years the availability of the EPA's STORET system and similar systems has been a factor in reducing the amount of unusable data collected. Collected data is under-utilized for 4 reasons: (1) the regulatory maze, (2) existing data on BOD and some of the simpler water quality parameters were not incorporated into the more complicated systems set up by the environmentalists of the 1970's, (3) access to data bases has been difficult, and (4) mathematical tools for handling data have been unavailable or very complex. The experience of water quality monitoring in Illinois is described. Although the sampling program has been redesigned, practical considerations, such as obtaining flow data, etc., have interfered with progress. The best strategy is to use fixed station monitoring with statistically designed schemes with supplemental data from intensive sampling where necessary. (Cassar-FRC)
W83-00429

COMPONENTS OF VARIATION IN LEAD, CADMIUM, COPPER, AND ZINC CONCENTRATION IN HOME DRINKING WATER: THE SEATTLE STUDY OF TRACE METAL EXPOSURE,

National Heart, Lung, and Blood Inst., Bethesda, MD. Epidemiology and Biometry Program.
A. R. Sharrett, R. M. Orheim, A. P. Carter, J. E. Hyde, and M. Feinleib.
Environmental Research, Vol 28, No 2, p 476-498, 1982. 5 Tab, 12 Ref.

Descriptors: *Metals, *Drinking water, Quality control, Variation coefficient, Heavy metals, *Trace metals, *Pollutant identification, Lead, Cadmium, Copper, Zinc, Sampling, *Seattle, *Washington, Chemical analysis, Precision, Standard deviation, Sample preparation, Sample preservation.

Substantial variation in trace metals concentrations (Pb, Cd, Cu, and Zn) was observed in water samples collected from a single home over a period of time during a Seattle, Washington, study. The variation was studied using open and blind duplicates, samples split for analysis at 2 laboratories, and samples collected at the same home several months apart. The variation over time was real. A small portion of the variation was the result of factors operating after sample collection and preservation, for example, use of furnace atomizer. Most variation at higher concentrations was related to intralaboratory factors; most at lower concentrations, to extralaboratory factors. Some of the sources of variation were inadequate mixing of samples containing particulate matter, contamination by or adsorption onto container walls, dilution, sequence of analysis, and operator or instrument errors. (Cassar-FRC)
W83-00432

PHTHALATE ESTER CONCENTRATION VARIATIONS IN DATED SEDIMENT CORES FROM THE CHESAPEAKE BAY,
Ecole Polytechnique, Palaiseau (France). Lab. de Chemie Analytique Physique.
For primary bibliographic entry see Field 5B.
W83-00434

HALOCARBONS AS TRACER SUBSTANCES IN STUDIES OF THE DISTRIBUTION PATTERNS OF CHLORINATED WATERS IN COASTAL AREAS,
Goeteborg Univ. (Sweden); and Chalmers Univ. of Tech., Goeteborg (Sweden). Dept. of Analytical and Marine Chemistry.
For primary bibliographic entry see Field 5B.
W83-00435

CHLOROBENZENES IN SEDIMENTS, WATER, AND SELECTED FISH FROM LAKES SUPERIOR, HURON, ERIE, AND ONTARIO,
Canada Center for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 5B.
W83-00444

DETERMINING FREE AVAILABLE CHLORINE BY DPD-COLORIMETRIC, DPD-STEADIFAC (COLORIMETRIC), AND FACTS PROCEDURES,
Florida International Univ., Miami.
W. J. Cooper, N. M. Roscher, and R. A. Slifker.
Journal of the Americal Water Works Association, Vol 74, No 7, p 10, 362-368, July, 1982. 12 Fig, 4 Tab, 16 Ref.

Descriptors: *Residual chlorine, *Water analysis, *Drinking water, Colorimetry, Stability, Nitrogen trichloride, Chlorine, Potable water, Water quality, *Pollutant identification.

Three methods are described for determining free residual chlorine. Interferences from combined chlorine, color formation and stability, reagent stability, theoretical detection limits, and accuracy and precision of data, as well as the feasibility of preparing pure aqueous solutions of nitrogen trichloride are considered. The free available chlorine test with syringaldazine (FACTS) procedure showed no intrusion into the FAC reading from ammonium chloride concentrations up to 24 mg/l 1 min after mixing the reagents. After 5 min, the two high concentrations of ammonium chloride did yield an apparent free chlorine reading of about 0.2 mg/l. The N,N-diethyl-p-phenylenediamine (DPD) colorimetric procedure showed no intrusion into the FAC reading from ammonium chloride concentrations up to 24 mg/liter, 1 min after mixing for the two lower levels of ammonium chloride, 1.2 and 3.5 mg/l. At ammonium chloride concentrations of 6.4, 13.2 and 24.2, apparent free chlorine levels were 0.2, 0.54, and 1.35, respectively, after 1 min. Under stability considerations, the DPD procedures showed greater fading of colored product at lower FAC concentrations than at higher concentrations. In all cases fading was higher than for data previously published for the FACTS procedure. Stability of DPD reagent depends on pH. Thioacetamide solution were tested through 4.5 months with no adverse aging effect noted. All three procedures showed intrusion of NC13 into the free chlorine readings, with the magnitude of intrusion being greater for FACTS at the two higher NC13 concentrations and greater for the DPD procedures at the two lower NC13 concentrations. (Baker-FRC)
W83-00453

BIOLOGICAL SURVEILLANCE OF RIVERS,
Aston Univ., Birmingham (England). Dept. of Biological Sciences.
H. A. Hawkes.
Water Pollution Control, Vol 81, No 3, p 329-342, 1982. 6 Fig, 4 Tab, 39 Ref.

Descriptors: *Monitoring, *Biological samples, *Sampling, *Rivers, Water pollution effects, Classification, Benthic fauna, Water quality, Species diversity, Diversity indices, *Pollutant identification.

Biological surveillance is an essential complement to physicochemical surveillance in monitoring river water quality. Biological surveillance can contribute to knowledge of water quality because benthic communities reflect the continuous, rather than intermittent, water quality; they respond to a wide range of pollutants; and they are good indicators of the effects of pollutants on fish. However, there are some limitations. Biological surveillance cannot identify the chemicals causing an observed change. Sampling and identification involve considerable effort. Data generated from a biological survey are often hard to understand by non-biologists; indexes often obscure information. Although water may be designated of good quality by biological surveillance, it may contain harmful trace organics or pathogens. Sampling methods are described. In the United Kingdom methods rely on benthic samples collected, if possible, from shallow stretches with a strong bottom or eroding substratum. Many indexes for water quality exist: the saprobic system, biotic indexes, diversity indexes, a classification system (characterized by indicative groups of animals), the BMWP score (biological monitoring working party), and ecological validity (based on changes in indicator species). (Cassar-FRC)
W83-00472

CONTINUOUS MONITORING, AUTOMATED ANALYSIS, AND SAMPLING PROCEDURES,
Oak Ridge National Lab., TN.
W. W. Pitt, Jr., and M. S. Denton.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 54, No 6, p 576-583, June 1982. 107 Ref.

Descriptors: *Automation, *Water quality control, *Water sampling, *Literature review, Sampling, Monitoring, Effluents, Water analysis, Continuous monitoring, Computers, Wastewater analysis, Process control, *Pollutant identification, Bioindicators, Heavy metals, Water pollution control.

Publications on monitoring strategies and sampling protocols, continuous monitoring applications, automated analyses, biological monitoring systems, and sampling procedures and devices are reviewed. Effluent monitoring was emphasized. Other papers covered sampling networks; wastewater and groundwater monitoring; selection of sampling techniques, frequencies, and equipment; and the importance of equipment cleanliness and filtering apparatus. In the area of pollution control monitors, there were significant developments in the determination of COD, BOD, total organic carbon, and alkalinity; in monitors and alarms for reporting spills; in the chemical processes area of the industrial sector; in the utilities industry; and in a class A monitor for general use with water systems for continuous analysis. On-line process control monitoring experienced growth in electronic devices for sludge/wastewater treatment, biotreatment, energy production facilities, and industrial chemical processing. Process liquid chromatography was studied. Publications on automated analyses covered the use of rapid and automated measurements that were not continuous or on-line. Biological monitoring systems to screen natural waters for heavy metals were cited. An evaluation of macroreticular resins for the sampling of organics in water was cited along with a description of a multichannel positive displacement apparatus for collecting composited samples of waterborne trace organics. (Gish-FRC)
W83-00488

INACCURACY OF THE PREINCUBATION MODIFIED M-FC METHOD FOR ESTIMATING FECAL COLIFORM DENSITIES IN MARINE WATERS,
Rhode Island Univ., Kingston. Dept. of Microbiology.
V. J. Cabelli, F. T. Brezenski, and D. Pedersen.
Journal of the Water Pollution Control Federation, Vol 54, No 8, p 1237-1240, August, 1982. 1 Fig, 7 Tab, 13 Ref.

Descriptors: *Coliforms, *Bacteria, *Incubation, *Pollutant identification, Microbiological studies, Marine environment, Estuarine environment.

Two methods for estimating fecal coliform densities in marine and estuarine water samples were compared. The mM-FC method was the M-FC method modified by preincubation of plates for 2 hours at 35C and incubation at 44.5C for 22 additional hours. The mTEC membrance filter involved counting all the yellow colonies on the filter prior to performance of the in situ urease test to distinguish between E. coli and Klebsiella. In general, the mM-FC procedure gave lower estimates than the mTEC method for E. coli. Mean fecal coliform recoveries (in cells per 100 ml) for mM-FC and mTEC respectively were: New Jersey coast, 8.8 vs. 31.3; Long Island coast, 10.1 vs. 19.3; 6 Staten Island sites, 8.7-55.5 vs. 28.3-207; 6 Coney Island sites, 5.6-48.4 vs. 60.2-269. The confirmation frequency for the mTEC method was 92-100%, depending on the station. (Cassar-FRC)
W83-00491

AN AUTOMATIC VOLTAMMETRIC ANALYZER FOR THE SIMULTANEOUS DETERMINATION OF TOXIC TRACE METALS IN WATER,
Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Angewandte Physikalische Chemie.
For primary bibliographic entry see Field 7B.
W83-00510

CATION-EXCHANGE BEHAVIOUR OF A RANGE OF ADSORBENTS AND CHROMATOGRAPHIC SUPPORTS WITH REGARD TO THEIR SUITABILITY FOR INVESTIGATING TRACE METAL S PECIATION IN NATURAL WATERS,
Commonwealth Scientific and Industrial Research Organization, Cronulla (Australia). Div. of Fisheries and Oceanography.
D. J. Mackey.
Journal of Chromatography, Vol 242, No 2, p 275-287, 1982. 12 Fig, 1 Tab, 30 Ref.

Descriptors: *Adsorbents, *Trace metals, *Ion exchange, *Speciation, Activated carbon, Resins, *Chromatography, *Pollutant identification, Adsorption, Metals, Iron, Copper, Zinc, Magnesium, Cation exchange.

The behaviour of adsorbents and chromatographic supports in adsorbing trace metals from water was

studied using a liquid chromatograph with an atomic fluorescence detector. The stock solution contained 10 mg per liter each of Fe, Mg, Cu, and Zn at pH 2.5. XAD-2, Chromosorb 101 and 102, Porapak P, PS, Q, and QS, Benson BN-X4 and BN-L10 (all cross-linked polyaromatic resins) and Sep-Pak (octadecyl bonded silica) acted as cation exchange resins with capacities of about 0.1-0.5 microequivalents per g. Norit A (activated carbon) and XAD-7 and 8 (polyacrylic ester resins) had much higher cation exchange capacities. Although the cation exchange capacities reported in this study are low, they can significantly affect results in studies of metal speciation in natural waters. The structure of the octadecyl bonded silica offers the possibility of using this in speciation studies because metal-organic complexes may be more easily desorbed. However, elutants are limited to pH 2-8, and the silica surface must be bonded to as many alkyl groups as possible, since free silanol groups bond strongly to trace metals. (Cassar-FRC)
W83-00517

CHEMILUMINESCENCE METHOD FOR THE DETERMINATION OF TRACE AMOUNTS OF PROTEINS IN NATURAL WATERS,
Kiev Polytechnical Inst. (USSR).
L. V. Kalabina, B. I. Nabivanets, and I. S. Matsko.
Hydrobiological Journal, Vol 17, No 3, p 90-96, 1981. 4 Fig, 5 Tab, 9 Ref.

Descriptors: *Water analysis, *Proteins, *Chemiluminescence, *Pollutant identification, Amino acids, Luminescence, Hydrolysis, Trace levels, *USSR, Dniepr River.

The chemiluminescence method detected protein in natural water at levels of 1 microgram per 25 ml water at reproducibilities of 4-10%. It was based on dialysis of the water to remove interfering material, hydrolysis of protein using a base (barium hydroxide), followed by determination of the liberated amino acids by measuring the inhibitory effect on the oxidation of luminol by hydrogen peroxide in the presence of Cu. Sensitivity of different proteins varied from 5 micrograms per 5 ml for human albumin to 1200 micrograms per 5 ml for trypsin. Water samples from the Dniepr River, collected March 1978, contained 1.4-9.6 micrograms protein per 25 ml water. (Cassar-FRC)
W83-00580

RA-228, RA-226, RN-222, IN SOUTH CAROLINA GROUND WATER: MEASUREMENT TECHNIQUES AND ISOTOPE RELATIONSHIPS,
South Carolina Univ., Columbia. Dept. of Geology.
J. Michel, P. T. King, and W. S. Moore.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-125286, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Research Institute Technical Report No 95, Clemson University, Clemson, South Carolina, January 1982. 57 p, 11 Fig, 6 Tab, 27 Ref, 1 Append. OWRT B-127-SC(2), 14-34-0001-9158.

Descriptors: Water pollution, *Radioactive tracers, *Radioactivity techniques, *Radium radioisotopes, *Radioecology, *Spectroscopy, Radioactive wastes, Radioactivity, Radiochemical analysis, Radioisotopes, Radon, Uranium, *South Carolina, Thorium, Groundwater pollution, Water analysis, Well water, Gamma radiation, *Pollutant identification.

A new technique using gamma-ray spectroscopy was developed for the accurate measurement of radium (Ra) isotopes in natural water, and applied to the determination of Ra-228 and Ra-226 activities in over 180 public water supplies from wells in igneous and metasedimentary rocks in the South Carolina Piedmont province and in Coastal Plain sediments. It was found that the migration distances of Radon-222, Ra-226, and Ra-228 by groundwater were similar, and that temporal variations of the isotopes were negligible. Further, the groundwater isotope data for the Coastal Plain province closely paralleled the NURE Augusta 1-degree by 2-degree stream sediment data. Analysis showed the Upper Coastal Plain to have high radio element levels. Correlation of thorium and uranium (U) in stream sediment and Ra-229 with Ra-226 in groundwater showed that the noted elevated U abundances in the Upper Coastal Plain were probably not from secondary concentration by geochemical processes. While the findings may exclude use of Ra isotopes as natural tracers of groundwater age, the groundwater Ra-228/Ra-226 activity ratio appears directly related to the relative abundances of thorium and U in the aquifer solids. Thus, groundwater Ra content could be used as a U exploration tool. (Zielinski-MAXIMA)
W83-00625

EVALUATION OF THE TENTATIVE STANDARD METHOD FOR ENTERIC VIRUS CONCENTRATION AND DETECTION,
North Carolinia Univ. at Chapel Hill. School of Public Health.
M. D. Sobsey.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-108416, Price codes: A05 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S1-81-061, February 1982. 4 p.

Descriptors: *Viruses, *Drinking water, *Water analysis, *Virus concentration methods, Coxsackie virus, Enteroviruses, Polioviruses, Water quality, Water pollution.

The tentative Standard Method (TSM) for concentrating enteric viruses from large volumes of drinking water and other finished waters was evaluated for nine enteric viruses using 100-gal tap water volumes experimentally contaminated with about 100 plaque-forming units (PFU) of virus. The mean recoveries of poliovirus-1, coxsackieviruses A9 and B3, echovirus 7, bovine enterovirus 1, Minute Virus of Mice (parvovirus), reovirus 3, adenovirus 5 and simian adenovirus 11 were 22, 25, 2.5, 6.7, 22, 5.0, <1, <1, and <1%, respectively. TSM recoveries for purified, dispersed mixtures of enteroviruses obtained from raw sewage and seeded into 100-gal volumes of tap water averaged only 3.9%. Enterovirus recoveries showed marked seasonal variations that may be related to water quality changes. Reduced virus recovery was partly due to interference with virus adsorption to filters caused by soluble or colloidal tap water constituents that were removed by granular activated carbon. The effects of these interferences could be overcome by adding aluminum or magnesium chloride to enhance virus adsorption. Low virus recoveries by the TSM were also due to virus inactivation by the pH 11.5 glycine - NaOH used for eluting adsorbed viruses from filters. Improved virus recoveries were also obtained with adsorbent filters that are more electropositive than TSM filters. (Moore-SRC)
W83-00629

DEVELOPMENT OF ANALYTICAL TEST PROCEDURES FOR ORGANIC POLLUTANTS IN WASTEWATER - APPLICATION TO PESTICIDES,
Midwest Research Inst., Kansas City, MO.
H. Miller, P. Cramer, A. Drinkwine, A. Shan, and G. Trischan.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-132507, Price codes: A05 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S4-81-017, January 1982. 4 p, 2 Tab.

Descriptors: *Wastewater analysis, *Pesticides, *Industrial wastewater, *Chromatography, Effluents, Cost analysis, Monitoring.

Pesticides are an important group of toxic compounds which have come under scrutiny for control by the National Pollutant Discharge Elimination System permits program. Procedures were developed for monitoring concentrations of 58 pesticides in industrial discharge wastewater. Objectives were to minimize the cost of performing the analysis and maximize the probability of obtaining accurate results. The procedures involved: solvent extraction; extract concentration; adsorbent column cleanup; and gas or high pressure liquid chromatographic determination. The procedures were developed and evaluated using relevant industrial wastewater. In order to minimize the cost of performing the analysis, three ideas were incorporated in the philosophical approach to the method development: multiresidue methods, wherein several compounds may be determined by one analysis were favored; standard analytical techniques and instruments, in common use, were incorporated in the methods; and techniques used in approved EPA procedures were favored because of their future side-by-side use with these pesticide methods. (Moore-SRC)
W83-00632

MONITORING TO DETECT GROUNDWATER PROBLEMS RESULTING FROM ENHANCED OIL RECOVERY,
Energy Resources Co., Inc., Cambridge, MA.
For primary bibliographic entry see Field 5B.
W83-00635

THE USE OF URIC ACID AS A METHOD OF TRACING DOMESTIC SEWAGE DISCHARGES IN RIVERINE, ESTUARINE AND COASTAL WATER ENVIRONMENTS,
Plymouth Polytechnic (England).
L. Brown, J. Braven, M. M. Rhead, R. Evens, and E. I. Butler.
Water Research, Vol 16, No 9, p 1409-1411, September, 1982. 1 Fig, 1 Tab, 6 Ref.

Descriptors: *Uric acid, *Tracers, *Effluents, Nitrogen compounds, *Pollutant identification, *Chromatography, Estuarine environment, Coastal waters, Fate of pollutants, Saline water.

A high performance liquid chromatographic method for determining low levels of uric acid in estuarine and coastal waters was developed. This acid, present in untreated sewage but not in unpolluted waters, is useful as a tracer for sewage in water bodies. The procedure can handle samples containing 1-10,000 micrograms per liter of uric acid. Precision is + or - 20% at 2 micrograms per liter, + or - at 40 micrograms per liter, and + or - 2% at 10,000 micrograms per liter. Samples collected from the Tamar Catchment, England, contained 450-2600 micrograms uric acid per liter untreated sewage, 590-2750 micrograms per liter primary effluent, < 1 microgram per liter secondary effluent, and 290-350 micrograms per liter secondary effluent plus storm overflow. No uric acid was detected in waters unaffected by recent domestic sewage discharges. (Cassar-FRC)
W83-00646

MICROBIOLOGY: DETECTION OF BACTERIAL PATHOGENS AND THEIR OCCURRENCE,
Environmental Protection Agency, Cincinnati, OH. Drinking Water Research Div.
D. J. Reasoner.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 54, No 6, p 946-980, June, 1982. 7 Tab, 147 Ref.

Descriptors: *Literature reviews, *Bacteria, *Public health, Reviews, Human diseases, *Pathogens, Animal diseases, Microbiological studies, Water quality, Water analysis, Water pollution sources, Bacterial analysis, Antibiotic resistance.

Recent research in the area of detection of bacterial pathogens is cited in this review of the literature. In the area of bacterial pathogens in animals research centered on member of the genus Salmonella, on antibiotic-resistant strains and the problems they pose, on the isolation of S. typhimurium from cattle in Japan, on the distribution of members of this genus in both warm and cold blooded animals and in insects, on Leptospirosis as primarily a disease of animals but which is transmitted to humans through direct contact and indirectly by contact with a contaminated environment including water, and on surveys of the incidence of leptospirosis in animals. The detection and identification of waterborne bacterial pathogens was carried forward in research dealing with the most-

probable number procedure, with the detection and enumeration of specific pathogens to assess both the incidence of waterborne disease and the relative risk exposure of an animal or human population, and with human disease outbreaks associated with contaminated air conditioning cooling tower waters and contaminated shower heads in health care institutions. (Baker-FRC)
W83-00658

DISSOLVED-OXYGEN AND ALGAL CONDITIONS IN SELECTED LOCATIONS OF THE WILLAMETTE RIVER BASIN, OREGON,
Geological Survey, Portland, OR. Water Resources Div.
F. A. Rinella, S. W. McKenzie, and S. A. Wille.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: $10.75 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 81-529, 1981. 76 p, 19 Fig, 26 Tab, 25 Ref.

Descriptors: *Dissolved oxygen, *Algae, *Water pollution, *Rivers, Water quality control, Biochemical oxygen demand, Nitrification, Solar radiation, Model studies, Sampling, Photosynthesis, *Oregon, Willamette River.

During July and August 1978, the U.S. Geological Survey, in cooperation with the Oregon Department of Enviromental Quality, made three intensive river-quality dissolved-oxygen studies in the upper Willamette River basin. Two studies were made on the upper Willamette River and one was made on the Santiam River, a Willamette River tributary. Nitrification, occurring in both the upper Willamette and South Santiam Rivers, accounted for about 62% and 92% of the DO sag in the rivers, respectively. Rates of nitrification were found to be dependent on ammonia concentrations in the rivers. Periphyton and phytoplankton algal samples were collected on the main stem Willamette River and selected tributaries during August 1978. Diatoms were the dominant group in both the periphyton and phytoplankton samples. The most common diatom genera were Melosira, Stephanodiscus, Cymbella, Achnanthes, and Nitzschia. Comparisons with historical data indicate no significant difference from previous years in the total abundance or diversity of the algae. (USGS)
W83-00696

5B. Sources Of Pollution

GENERATION OF FECAL AND TOTAL COLIFORM SURGES BY STREAM FLOW MANIPULATION IN THE ABSENCE OF NORMAL HYDROMETEOROLOGICAL STIMULI,
Leeds Univ. (England). School of Geography.
A. McDonald, D. Kay, and A. Jenkins.
Applied and Environmental Microbiology, Vol 44, No 2, p 292-300, August, 1982. 9 Fig, 20 Ref.

Descriptors: *Bacteria, *Recreation, *Reservoir releases, *England, Water quality management, Fate of pollutants, Coliforms, Thruscross Reservoir, Fewston Reservoir, River Channels, Sediments, Channel flow, Land use, Public health.

Total coliform bacteria and Escherichia coli levels increased more than 10-fold in response to reservoir releases from Thruscross Reservoir through a 3 km stream into Fewston Reservoir in north Yorkshire, England. Artificial high stages were created after rainless periods on 8 occasions from October 1979 to March 1981. Results suggest the existence of 2 stores of bacteria, one on land and one in and near the channel. The land store of bacteria is influenced by manure spreading, stock density, and other management practices and by decay processes. Transport from the land store to the channel store depends on the hill slope factors of overland flow, throughflow, and groundwater flow. The channel store of bacteria is influenced by physicochemical characteristics of the water, nutrients, bed characteristics, and time elapsed since the last transfer event. Transport from the channel to the water depends on stage and velocity changes in flow, frequency of stage and velocity changes, and channel characteristics. During an artificial release for a day's slalom canoeing on September 5, 1980, bacteria in the water increased during the rising limb of the hydrographs to 1000-10,000 per 100 ml, 10-30 times the baseflow concentration. These levels can exceed recommended guidelines for water quality in contact sports. An advisable management practice is to flush the stream before a scheduled water sports event so that bacterial levels can return to lower levels before contact occurs. (Cassar-FRC)
W83-00385

FATE OF VIRUS IN WASTEWATER APPLIED TO SLOW-INFILTRATION LAND TREATMENT SYSTEMS,
Army Medical Bioengineering Research and Development Lab., Fort Detrick, MD.
S. A. Schaub, H. T. Bausum, and G. W. Taylor.
Applied and Environmental Microbiology, Vol 44, No 2, p 383-394, August, 1982. 3 Fig, 7 Tab, 19 Ref.

Descriptors: *Land disposal, *Wastewater irrigation, *Viruses, Fate of pollutants, Wastewater disposal, Irrigation water, Spray irrigation, Infiltration, Coliphages, Polioviruses, Wastewater treatment, New Hampshire.

Primary and secondary wastewaters were applied by spray irrigation to sandy loam and silt loam soils to study the removal of seeded coliphage f2 and enteroviruses during land treatment at Hanover, New Hampshire. The f2 concentration in leachates recovered at the 170 cm level were usually below detectable levels and did not exceed 0.1% of the applied virus levels during the 53-day study period. Indigenous enteroviruses showed similar characteristics. At 10 days after seeding f2 was present throughout the soil column and tended to accumulate around the soil core at medium depths. Recoverable coliphage f2 had disappeared from the surface zone (0-2.5 cm) by days 30-31. Zones of persistence were noticeable at about 23 cm and 69-99 cm depths at the beginning, middle, and end of the test period. The adsorptive capacity of the soils for poliovirus 1 and coliphage f2 increased greatly with the soil sample depth up to a maximum at mid-depth. Better adsorption (1-3 orders of magnitude) was obtained with distilled water plus CaC12 or bottom drain percolate than with secondary sewage or 45 cm percolate. Although the results of this study support land application of wastewater to agricultural soils as an excellent treatment method, site managers should be aware that prolonged wastewater application can tie up virus adsorption sites, allowing some viruses to reach shallow groundwater. (Cassar-FRC)
W83-00386

SURVIVAL IN LAKE WATER OF KLEBSIELLA PNEUMONIAE DISCHARGED BY A PAPER MILL,
Helsinki Univ. (Finland). Dept. of Microbiology.
S. I. Niemela, and P. Vaatanen.
Applied and Environmental Microbiology, Vol 44, No 2, p 264-269, August, 1982. 3 Fig, 2 Tab, 19 Ref.

Descriptors: *Bacteria, *Pulp and paper industry, *Temperature effects, Fate of pollutants, Coliforms, Klebsiella pneumoniae, Lakes, Survival, Model studies, *Finland, Lake Lohjanjarvi, Kymi River.

The survival of Klebsiella pneumoniae was investigated at 8 temperatures from 0 to 20C in water (Lake Lohjanjarvi, Finland) receiving discharges from a paper mill. Samples were collected at distances from 1 to 5.5 km from the mill. Semilogarithmic plots of bacterial densities as a function of distance were linear, with slopes depending on water temperature. Larger slopes were produced by the higher temperatures. Regression equations were calculated for the dependence of death rate on temperature alone and on both temperature and discharge. The temperature coefficient of the death rate was 2.1 + or - 0.4. The 90% reduction time at 0C was calculated to be 24 days; at 20C, 5 days. A 10C rise in temperature approximately doubled the death rate. Observations from the Kymi River were used to verify the regression model. Predicted reduction was 23%; observed reduction was 29%. Several factors affect the reliability of the predictions including long-term variations in effluent discharge, incomplete mixing, variations in travel velocity, and variation in solar radiation. (Cassar-FRC)
W83-00387

WIDESPREAD DISTRIBUTION OF ABILITY TO OXIDIZE MANGANESE AMONG FRESHWATER BACTERIA,
Rollins Coll., Winter Park, FL. Dept. of Biology.
E. Gregory, and J. T. Staley.
Applied and Environmental Microbiology, Vol 44, No 2, p 509-511, August, 1982. 2 Tab, 10 Ref.

Descriptors: *Manganese, *Bacteria, *Oxidation, Fate of Pollutants, *Heterotrophic bacteria, Lake Washington, Seattle, *Washington, Lake Virginia, Winter Park, *Florida.

Manganese-oxidizing bacteria were enumerated in Lake Washington, Seattle, and Lake Virginia, Winter Park, Florida, on 7 occasions from June 1977 to December 1978 at depths to 57 m. The percentage of the heterotrophic population that could oxidize Mn varied throughout the year from 6 to 62% with no consistent seasonal or vertical distribution patterns. A wide variety of isolates were capable of Mn-oxidation. These included Bacillus, Caulobacter, Chromobacterium, Cytophaga, Hyphomicrobium, and Pseudomonas. All of the organisms but Bacillus lost their ability to oxidize Mn after a year of growth in the laboratory. The presence of plasmid DNA was correlated with the ability of the organism to oxidize Mn. (Cassar-FRC)
W83-00390

MEASUREMENT OF AQUATIC BIODEGRADATION RATES BY DETERMINING HETEROTROPHIC UPTAKE OF RADIOLABELED POLLUTANTS,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
F. K. Pfaender, and G. W. Bartholomew.
Applied and Environmental Microbiology, Vol 44, No 1, p 159-164, July, 1982. 3 Fig, 3 Tab, 11 Ref.

Descriptors: *Organic compounds, *Biodegradation, *Fate of pollutants, *Trichlorobenzene, Cresol, Chlorobenzene, Nitrilotriacetic acid, Brackish water, Natural waters, Seawater, Uptake, *North Carolina.

The development and preliminary results are presented of a simple, rapid technique for measuring rates of organic pollutant biodegradation in natural aquatic samples. The method is based on the uptake and mineralization of radiolabeled pollutant substrates. The amount of substrate incorporated into cellular material and mineralized is measured and can be used to calculate metabolic velocity. The procedure was used to assess the biodegradation rates of m-cresol, chlorobenzene, nitrilotriacetic acid, and 1,2,4-trichlorobenzene in fresh, brackish, and marine water samples from the coastal areas of North Carolina. Saturation kinetics for uptake was obtained with each of the compounds tested. Rates of metabolism were dependent on sample location and time of year. (Baker-FRC)
W83-00392

FACTORS AFFECTING THE TOXIC EFFECT OF TIN ON ESTUARINE MICROORGANISMS,
Cornell Univ., Ithaca, NY. Dept. of Agronomy.
For primary bibliographic entry see Field 5C.
W83-00393

HYDROBIOLOGICAL STUDIES OF EASTERN LESSER ANTILLEAN ISLANDS VII. ST. LUCIA: BEHAVIOURAL DRIFT AND OTHER MOVEMENTS OF FRESHWATER MARSH MOLLUSCS,
Waterloo Univ. (Ontario). Dept. of Biology.
W. B. McKillop, and A. D. Harrison.
Archiv fur Hydrobiologie, Vol 94, No 1, p 53-69, April, 1982. 1 Fig, 4 Tab, 11 Ref.

Descriptors: *Mollusks, *Marshes, *Aquatic drift, Snails, Pathogens, St. Lucia, Lesser Antilles, Islands, Diurnal variation, Fate of pollutants, Biomphalaria glabrata, Pyrogophorus parvulus, Pisidium punctiferum, Invertebrates.

Behavioral and catastrophic drift of fresh water mollusks from marshes into streams was studied on the island of St. Lucia, Lesser Antilles. Pyrgophorus parvulus, Biomphalaria glabrata and Pisidium punctiferum exhibited behavioral drift. Greater numbers of mollusks drifted at night than in daytime. Rainfall disrupted the diel pattern and increased daytime drift. The smallest sizes of P. parvulus and B. glabrata drifted in higher proportions than other age groups. Drift was sufficient to maintain a population in the streams and rivers. Although the distance crawled by B. glabrata during day and night were similar, feeding activity was 9.2 times greater during the night. A high proportion of individuals burrowed into the mud during the daytime. Release of the mollusks from the stationary position was often triggered by collisions or by raindrops. Movement of these mollusks is significant because they can carry pathogenic parasites. (Cassar-FRC)
W83-00395

OBSERVATIONS ON NITRATE, PHOSPHATE AND SILICATE IN CLEVELAND BAY, NORTHERN QUEENSLAND,
James Cook University of North Queensland, Townsville (Australia). School of Biological Sciences.
For primary bibliographic entry see Field 5A.
W83-00406

PHOSPHORUS EXPORT FROM COASTAL PLAIN DRAINAGE INTO THE PEEL-HARVEY ESTUARINE SYSTEM OF WESTERN AUSTRALIA,
Western Australia Dept. of Conservation and Environment, Perth.
P. B. Birch.
Australian Journal of Marine and Freshwater Research, Vol 33, No 1, p 23-32, 1982. 8 Fig, 1 Tab, 12 Ref.

Descriptors: *Phosphorus, *Fertilizers, Agriculture, Phosphate, Water pollution sources, Water pollution effects, Coastal plains, Estuaries, Land use, Peel-Harvey Estuary, *Australia, Farming, Soil types, Rainfall, Cattle, Runoff, Water pollution control, Algae, Eutrophication.

The export of phosphorus from the rural coastal plain catchments of the Peel-Harvey estuarine system, Western Australia, was positively correlated with rates of superphosphate fertilizer application, dairy farming, and the presence of alluvial clay soils, and negatively correlated with beef farming. These relationships were determined by linear regression analyses. A total of about 4000 tons P was applied to the 9600 sq km estuary catchment in 1977-78 (an average rainfall year, 820 mm) and in 1978-79 (a low rainfall year, 650 mm). Total exports of P during these seasons were 121 and 67 tons, respectively. The P input resulted in excess growth of the benthic alga Cladophora aff. albida. P input may be decreased by reducing or modifying the present use of superphosphate fertilizers, reducing soil erosion, and reducing runoff from dairy farms. (Cassar-FRC)
W83-00408

BIOACCUMULATION OF ORGANOCHLORINES BY YEARLING COHO SALMON (ONCORHYNCHUS KISUTCH WALBAUM) FED DIETS CONTAINING GREAT LAKES' COHO SALMON, AND THE PATHOPHYSIOLOGICAL RESPONSES OF THE RECIPIENTS,
Guelph Univ. (Ontario). Dept. of Zoology.
For primary bibliographic entry see Field 5C.
W83-00418

BACTERIAL WATER QUALITY: SPRINGS AND STREAMS IN THE GREAT SMOKY MOUNTAINS NATIONAL PARK,
Great Smoky Mountains National Park, Gatlinburg, TN. Uplands Field Research Lab.
For primary bibliographic entry see Field 5A.
W83-00426

DAILY INTAKE OF LEAD, CADMIUM, COPPER, AND ZINC FROM DRINKING WATER: THE SEATTLE STUDY OF TRACE METAL EXPOSURE,
National Heart, Lung, and Blood Inst., Bethesda, MD. Epidemiology and Biometry Program.
A. R. Sharrett, A. P. Carter, R. M. Orheim, and M. Feinleib.
Environmental Research, Vol 28, No 2, p 456-475, 1982. 1 Fig, 7 Tab, 21 Ref.

Descriptors: *Metals, *Drinking water, *Plumbing, *Trace metals, Heavy metals, Lead, Cadmium, Copper, Zinc, *Seattle, *Washington, Pipes, Water consumption, Corrosive water, Fate of pollutants, Water pollution sources.

The daily intake of metals in drinking water was estimated for persons living in Seattle, a city with an unusually corrosive water supply. The mean Cu intake by an adult male working outside the home (equipped with Cu piping) was 2.2 mg per day in standing water and 1.3 mg per day in running water. The adult dietary Cu requirement is 1.5 mg per day. Mean Pb intakes for adult males working outside the home (structures less than 5 years old) were 111 micrograms per day from standing water and 31 micrograms per day from running water. The FDA adult dietary estimated Pb intake is 79.3 micrograms per day. Cd intakes were 1-2 micrograms per day from galvanized pipe homes in Seattle, much less than the adult FDA dietary estimate of 36.9 micrograms per day. Metals concentrations were closely related to type of plumbing, galvanized plumbing being associated with Zn and Cd concentrations 10 times as high as in Cu pipe homes. Cu concentration were 10 times higher in Cu pipe homes than in galvanized pipe homes. Pb concentrations tended to be 50-70% higher in Cu pipe homes than in galvanized pipe homes. In homes with mixed piping materials, trace metals concentrations were slightly different than in homes with only one type of pipe. Other factors determining concentrations of metals in drinking water considered in the study were length of pipe between house shut-off valve and tap, age of house, type of service line, length and type of pipe between meter and main, and water supply source (Tolt or Cedar River). The determinants of Cu, Pb, Zn, and Cd concentrations in the drinking water were summarized. In calculating daily intakes the age and sex of the persons and their water consumption were considered. (Cassar-FRC)
W83-00431

PHTHALATE ESTER CONCENTRATION VARIATIONS IN DATED SEDIMENT CORES FROM THE CHESAPEAKE BAY,
Ecole Polytechnique, Palaiseau (France). Lab. de Chemie Analytique Physique.
J. C. Peterson, and D. H. Freeman.
Environmental Science and Technology, Vol 16, No 8, p 464-469, August, 1982. 7 Fig, 2 Tab, 31 Ref.

Descriptors: *Phthalates, Organic compounds, *Chemical wastes, Pollutant identification, *Sediment cores, *Chesapeake Bay, Estuaries, Water pollution sources, Tracer studies, Esters.

Concentrations of seven phthalate esters were determined in sections of two Chesapeake Bay sediment cores dating back to 1842. The limitations of small sample sizes and ppb levels were overcome by use of gas chromatography/mass spectrometry. All phthalate esters increased in concentration toward the sediment surface. The greatest increase was seen in bis(2-ethylhexyl) phthalate (DEHP), first synthesized in 1933. Its production rate and its accumulation rate in the sediments were closely correlated. In the core taken from sediments more impacted by the industries of Baltimore, DEHP concentrations were 20-29 ppb in the 1923-52 layer, 124 ppb in the 1963-68 layer, and 180 ppb in the 1974-79 layer. The core taken further south near the mouth of the Potomac River contained < 2.6 ppb DEHP in the 1924-32 layer and 12 ppb in the 1972-79 layer. Low levels of phthalates were found in layers predating their initial production. The most likely explanation for this phenomenon is bioperturbation by burrowing fauna. If DEHP production continues at its annual 6% increasing rate, pollution by this ester will double in 12 years. Since the production rate of DEHP, the production rate of total synthetic chemicals, and the profile of DEHP pollution closely parallel each other, this compound may be a useful indicator for mixed synthetic organic chemical concentrations in sediments. (Cassar-FRC)
W83-00434

HALOCARBONS AS TRACER SUBSTANCES IN STUDIES OF THE DISTRIBUTION PATTERNS OF CHLORINATED WATERS IN COASTAL AREAS,
Goeteborg Univ. (Sweden); and Chalmers Univ. of Tech., Goeteborg (Sweden). Dept. of Analytical and Marine Chemistry.
E. Fogelqvist, B. Josefsson, and C. Roos.
Environmental Science and Technology, Vol 16, No 8, p 479-482, August, 1982. 6 Fig, 15 Ref.

Descriptors: *Pulp wastes, *Cooling waters, *Chlorinated hydrocarbons, Tracers, *Pollutant identification, *Path of pollutants, Chloroform, Bromoform, Effluents, Bleaching wastes, Powerplants, Nuclear powerplants, Chlorination, Water treatment, Seawater, Coastal waters, Plumes, Monitoring, Distribution patterns, *Sweden.

The movements of effluent plumes in seawater off the Swedish coast were followed using haloforms produced in the chlorination process. Tracer substances used to define the plume included chloroform, produced from bleaching pulp wastes at a mill, and bromoform, produced by disinfection of cooling seawater at a nuclear powerplant. The analytical method used pentane extraction of 100 ml samples, followed by glass capillary gas chromatography with electron capture detection. The bleaching effluent contained 93 micrograms per liter chloroform when measured in June 1979. Isopleths were constructed for the concentrations at the 15 m depth, 9 micrograms per liter being the maximum concentration at the outfall. The powerplant effluent contained 100 micrograms per liter bromoform. Depth profiles showed that layers of bromoform concentration were formed, one at 6 m depth (powerplant origin) and one at 12-15 m depth (biogenic origin). This method is simple and rapid, permitting analysis of plumes before winds and currents disturb the patterns. (Cassar-FRC)
W83-00435

KEPONE DISTRIBUTION IN SELECTED TISSUES OF BLUE CRABS, CALLINECTES SAPIDUS, COLLECTED FROM THE JAMES RIVER AND LOWER CHESAPEAKE BAY,
William and Mary Coll., Gloucester Point, VA. Inst. of Marine Science.
M. H. Roberts, Jr.
Estuaries, Vol 4, No 4, p 313-320, December, 1981. 6 Fig, 4 Tab, 18 Ref.

Descriptors: *Crabs, *Insecticides, *Bioaccumulation, *Fate of pollutants, *Kepone, Chlorinated hydrocarbons, James River, *Virginia, Chesapeake Bay, Accumulation.

The Kepone concentrations in blue crab (Callinectes sapidus) muscle, gonad, and hepatopancreas tissue were determined in crabs collected in June, July, and August 1978 from 7 stations in the lower Chesapeake Bay and lower James River, Virginia. Median Kepone levels were 0.05 micrograms per g or less (considered uncontaminated) in all samples of crabs from the lower bay. In the lower James River concentrations of Kepone were higher. Maximum median Kepone concentrations (in micrograms per g) were: ovigerous females, 0.20 in backfin (BF) tissue, 0.10 in hepatopancreas (HP) tissue, and 0.25 in gonad (GO) tissue; nonovigerous females, 0.06 in BF, 0.40 in HP, and 1.12 in GO; males, 0.45 in BF, 0.18 in HP, and 0.32 in GO. (Cassar-FRC)
W83-00436

DESORPTION OF RU106, CS134, CS137, CE144 AND AM241 FROM INTERTIDAL SEDIMENT CONTAMINATED BY NUCLEAR FUEL REPROCESSING EFFLUENTS,
JRC, Varese (Italy). Radiochemistry Div.
D. A. Stanners, and S. R. Aston.
Estuarine, Coastal and Shelf Science, Vol 14, No 6, p 687-691, 1982. 1 Fig, 1 Tab, 17 Ref.

Descriptors: *Sediments, *Radioisotopes, *Adsorption, Fate of pollutants, Rubidium radioisotopes, Cesium radioisotopes, Cerium radioisotopes, Americium radioisotopes, Marine sediments, Estuaries, Fuel reprocessing, *Nuclear wastes, Ravenglass Estuary, Windscale plant, Irish Sea, *England, *Desorption, Interstitial areas.

Desorption of radionuclides from estuarine sediments impacted by the Windscale fuel reprocessing plant at the Ravenglass Estuary, England, was investigated in the laboratory. Desorption of Am241, Ce144, and Ru106 was negligible over a 10-day period. However, Cs134 and Cs137 were desorbed up to 30% of their original activity. In spite of the identical chemical properties of Cs134 and Cs137 the Cs134 was preferentially lost. This may be explained by the long-term irreversible fixing of the longer-lived Cs137 into the sediment. (Cassar-FRC)
W83-00437

POLLUTION FROM US EXPLOSIVES AND PROPELLANTS PRODUCTION,
For primary bibliographic entry see Field 5D.
W83-00441

THE CONCENTRATION, REACTIVITY AND FATE OF COPPER, NICKEL AND ZINC ASSOCIATED WITH A COOLING-WATER PLUME IN ESTUARINE WATERS,
Connecticut Univ., Groton. Dept. of Marine Sciences.
D. G. Waslenchuk.
Environmental Pollution, Series B, Vol 3, No 4, p 271-287, 1982. 4 Fig, 6 Tab, 8 Ref.

Descriptors: Metals, *Cooling water, *Thermal pollution, Water pollution sources, Fate of pollutants, Heavy metals, *Copper, *Nickel, *Zinc, Powerplants, Millstone Nuclear Power Station, Waterford, *Connecticut, Long Island Sound, Plumes, Corrosion, Adsorption, Pipes, Estuaries, *Nuclear powerplants.

Saline water from Niantic Bay passing through the once-through cooling system at the Millstone Nuclear Power Station, Waterford, Connecticut, was a source of dissolved and particulate Cu, Ni, and Zn in the receiving waters of Long Island Sound. Dissolved metals levels (micrograms per kg) in Long Island Sound waters far from the plant were: Cu, 1.2; Ni, 1.0; and Zn, 1.4 at a temperature of 16.75C. In the cooling water discharge metals levels (in micrograms per kg) were: Cu, 2.3; Ni, 3.5; and Zn, 1.5 at a temperature of 31.5C. Total metal concentrations (in micrograms per kg) including particulates dislodged from the piping were: Cu, 4.7; Zn, 3.1; and Ni, uncertain. As the discharge plume was diluted, some particulate Cu and Zn dissolved, adding to the dissolved fraction. However, dissolved Ni appeared to decrease in concentration in the plume, possible a result of adsorption to suspended matter. (Cassar-FRC)
W83-00443

CHLOROBENZENES IN SEDIMENTS, WATER, AND SELECTED FISH FROM LAKES SUPERIOR, HURON, ERIE, AND ONTARIO,
Canada Center for Inland Waters, Burlington (Ontario).
B. G. Oliver, and K. D. Nicol.
Environmental Science and Technology, Vol 16, No 8, p 532-536, August, 1982. 2 Fig, 5 Tab, 19 Ref.

Descriptors: *Chlorinated hydrocarbons, *Lakes, *Sediments, Fate of pollutants, Pollutant identification, Water analysis, *Chlorobenzenes, Organic compounds, Fish, Trout, Lake sediments, *Great Lakes, Lake Superior, Lake Huron, Lake Erie, Lake Ontario, Niagara River, Grand River, Effluents, Water pollution sources.

Concentrations of chlorobenzenes were determined in sediments, water, and fish from several Great Lakes; in water from the Grand and Niagara Rivers; in effluents from 4 sewage treatment plants; and in drinking water from 3 water treatment plants. Values are given for each of 11 chlorobenzene compounds from di- to hexa-substituted. Total mean levels of chlorobenzenes (in parts per trillion) in water samples were low: 51 in Lake Ontario, 4 in Lake Huron, 20 in drinking water, 19 in the Grand River, and 706 in wastewater effluents. Estimated removal of chlorobenzenes in the activated sludge process was 75-95%. In sediments the sum of the dichloro- through hexachlorobenzenes (HCB) was 10 ppb in Lake Superior, 26 ppb in Lake Erie, 38 ppb in Lake Huron, and 560 ppb in Lake Ontario. In Lake Ontario some unusual chlorobenzenes, involved in the manufacture of pesticides, were prevalent. Analysis of 1 cm sections of a Lake Ontario sediment core dating back to 1923 indicated that most HCB and other chlorobenzene inputs started about 1944. Trout from Lake Ontario contained markedly higher chlorobenzene levels (on the order of 100 ppb) than trout from the other lakes (< 35 ppb). Suspected major sources of chlorobenzene loading to Lake Ontario were waste disposal leachates and chemical manufacturing effluents. Many of these facilities are located in the Niagara Falls, New York, area. The source of the much smaller levels of chlorobenzenes in the other lakes was probably wastewater treatment plant effluents. (Cassar-FRC)
W83-00444

FATE OF FENITROTHION IN AQUATIC MICROCOSMS AND THE ROLE OF AQUATIC PLANTS,
Ottawa Univ. (Ontario). Dept. of Biology.
P. Weinberger, R. Greenhalgh, R. P. Moody, and B. Boulton.
Environmental Science and Technology, Vol 16, No 8, p 470-473, August, 1982. 6 Fig, 1 Tab, 19 Ref.

Descriptors: *Insecticides, *Aquatic plants, *Degradation, *Fenitrothion, Pesticides, Macrophytes, Algae, Sediment, Lac Bourgeois, *Quebec, *Fate of pollutants, Lakes, *Ontario.

The fate of a fenitrothion formulation (concentration in water, 10 ppm) was monitored in laboratory and field experiments under both light and dark conditions. The microcosms were constructed with water, sediment, and aquatic macrophytes to simulate the proportions found in eastern Ontario and western Quebec lakes. In all systems uptake and degradation of fenitrothion was more rapid in light than in dark. Degradation products were fenitrooxon, demethylfenitrothion, S-methylfenitrothion, carboxyfenitrothion, 3-methyl-4-nitrophenol, and a new degradation product, carboxyaminofenitrothion. In the dark only hydrolysis products were found. In the water/algae system (Chlorella and Chlamydomonas) fenitrothion uptake was virtually complete in 4 hours; the bioconcentration factor (BCF) was 417. In the water/plant system Elodea densa absorbed most of the fenitrothion within 2 day. The BCF was 76 and 24 for light and dark systems respectively, after 1 day. For a water/plant system containing Myriophyllum, Elodea, and Sagittaria (1:1:1 ratio) fenitrothion was rapidly adsorbed. Bioconcentration factors after 5 days were 370-488 for the 3 plants. Different derivatives were predominant in different plants. In the field tests the main sink was the sediment. Analysis of the degradation products in the systems indicates that uptake and degradation of fenitrothion in water is photocatalyzed and is oxidative. (Cassar-FRC)
W83-00448

ACCUMULATION BY FISH OF CONTAMINANTS RELEASED FROM DREDGED SEDIMENTS,
Bureau of Commercial Fisheries, Ann Arbor, MI. Great Lakes Fishery Lab.
J. G. Seelye, R. J. Hesselberg, and M. J. Mac.
Environmental Science and Technology, Vol 16, No 8, p 459-464, August, 1982. 1 Fig, 7 Tab, 12 Ref.

Descriptors: Fish, Dredging, *Bioassay, *Perch, Sediments, *Bioaccumulation, Accumulation, Fate of pollutants, Metals, Pesticides, *Polychlorinated biphenyls, Suspended sediments, Great Lakes.

Three experiments were used to study the accumulation of pollutants from 10 days exposure of yellow perch (Perca flavescens) to dredged sediments: (1) fish of hatchery and lake origin exposed to a suspension of nonaerated sediments, (2) fish of hatchery origin exposed to a suspension of nonaerated sediment, and (3) fish of hatchery origin exposed to a suspension of aerated sediment. Sediments obtained from Saginaw Bay contained polychlorinated biphenyls (PCBs), DDT, and metals. In experiment (1) hatchery fish had significantly higher concentrations of PCBs and Fe and significantly lower concentrations of Sb than control fish. Lake fish had significantly higher concentrations of As, Na, Cr, and Fe than control fish. In experiment (2) PCBs and Hg were higher in exposed than in control fish. In experiment (3) PCB's, DDE, Zn, Fe, Cs, and Se were significantly higher in exposed fish than in control fish. These results show that certain pollutants, especially PCBs, are readily and directly accumulated from resuspended sediments by fish. In addition, several recommendations for designing bioaccumulation tests were developed. Fish should be consistent with respect to size and origin. Sediments should be consistently handled with respect to oxidation-reduction and amount of sediment used. Water in tests should have the same hardness and salinity as water at the proposed dredging site (accumulation of metals is usually lower in hard water than in soft water). Bioaccumulation tests should be conducted for longer than 10 days where long-term impacts are important. (Cassar-FRC)
W83-00449

EVALUATING THE POTENTIAL FOR CONTAMINATING DRINKING WATER FROM THE CORROSION OF TIN-ANTIMONY SOLDER,
Herrera Environmental Consultants, Seattle, WA.
C. E. Herrera, J. F. Ferguson, and M. W. Benjamin.
Journal of the American Water Works Association, Vol 74, No 7, p 10, 368-375, July, 1982. 9 Fig, 8 Tab, 12 Ref.

Descriptors: *Drinking water, *Metals, *Plumbing, Pipes, Lead, Water pollution sources, Tin, Antimony, Water conveyance, Potable water, Tin oxide, *Corrosion.

A significant health hazard can arise to the public due to the corrosion of lead-based solders in plumbing. The replacement of lead-based solder with tin-antimony solder will remove the lead from potable water; however, the full significance of antimony in water is not at present known. Both theoretical and experimental evidence is presented for the effects of tin-antimony solder in corrosive water. The theoretical investigation of antimony corrosion, tin corrosion, and galvanic coupling relationships indicates that the leaching of antimony from solder may be inhibited by two mechanisms. The galvanic coupling relationships among tin, antimony, and copper indicate that the corrosion of tin is theoretically more favorable than that of antimony, so that tin may act as a sacrificial anode. Secondly, tin can be passivated by tin oxide, and the passivating film may also cover the antimony contained in solder, thereby inhibiting antimony corrosion. Experimental results indicate that 95-5 tin-antimony solder has excellent potential for replacing lead-based solders in private and commercial plubing systems. The increase of antimony in the drinking water appeared minimal, probably due to the sacrficial corrosion of tin and the formation of tin oxide. (Baker-FRC)
W83-00452

EFFECT OF INDUSTRIAL-RESIDENTIAL ZONES ON WATER QUALITY OF SURFACE STREAMS,
L. I. Aleksinskaya, V. M. Borishanskii, Y. E. Saet, and T. N. Filina.
Water Resources, Vol 8, No 4, p 409-415, July/August, 1981. 4 Tab, 4 Ref. Translated from Vodnye Resursy, No 4, p 118-125, July/August, 1981.

Descriptors: *Industrial wastewater, *Metals, *Sediments, Water pollution sources, Fate of pollutants, Water pollution prevention, Heavy metals, Suspended sediments, Wastewater treatment, Trace metals, Settling basins, Inorganic compounds, Suspended solids, *USSR.

The quality of surface waters in 2 industrial-residential zones in the USSR was compared. Emphasis was on inorganic constituents. Labeled Zone Y and Zone X, the 2 drainage areas were similar in area, stream discharges, wastewater treatment (open settling ponds), and total numbers of industrial workers. In Zone Y the predominant industrial activities were machining of nonferrous metals, construction, and petroleum refining. In Zone X the manufacturing was concentrated on electronics (using nonferrous and rare metals) and textile and dyeing industries. Stream water from both zones was higher than background levels in pH, 2 times the total mineralization, 10-14 times higher in ammonium, 2-2.5 times higher in sulfate, and 3-3.5 times higher in ferric ion. Zone Y had 13 times higher turbidity levels, 150 times higher nitrates, and 60 times higher ferrous ion than background levels. Zone X had 20 times higher turbidity, 109 times higher nitrate, and 120 times higher ferrous ion than background levels. Concentration factors for elements in suspended solids of stream water in Zone Y were: Cd, V, Hg, all 1; Ni, 2; Cr, 4; Sn, > 4; Mo, 5; Ti, 6; Zn, 9; W, > 9; La, > 17; Ag, 18, and Cu, 63; for Zone X: W and Sn, 2; Cr, 2.5; Cu, 4; Ni, >4; La, 8; Mo, Ti, and Hg, > 10-12; Zn, 19; V, 21; Ag, > 75, and Cd, > 1400. The water soluble phase of the streams contained a similar complex of elements. These factors reflect the type of industry predominating in each zone: Cd, Ag, Hg, Ni, and Zn in electronics; V and Ti in textiles; Cr and W in structural steels; and Cu in electrical engineering. The treatment plant settling ponds in Zone Y retain most of the polluting elements, but in Zone X most are carried into the receiving stream. It was suggested that the high metals contents of the industrial wastewaters be reduced by pretreatment at the plants. The contaminated suspended material should also be removed by settling ponds at the plants or at the municipal treatment plant. Water quality can also be improved by aeration and oxidation of reduced complexes (Fe, Mn, and organics). (Cassar-FRC)
W83-00460

THE CHARACTER AND DISPERSAL OF MOTORWAY RUN-OFF WATER,
Victoria Univ. of Manchester (England). Pollution Research Unit.
E. G. Bellinger, A. D. Jones, and J. Tinker.
Water Pollution Control, Vol 81, No 3, p 372-390, 1982. 7 Fig, 6 Tab, 49 Ref.

Descriptors: *Highways, *Storm water, *Deicers, Water pollution sources, Fate of pollutants, Roads, Sodium, Chlorides, Nitrates, Runoff, Rainstorms, Water quality, Suspended sediments, Groundwater pollution.

Surface water runoff and sediment deposits from a 680 m stretch of the Blackpool Link section of a motorway in England were monitored after selected rainstorms from January 1976 to December 1977. Peak monthly concentrations of Na, Mg, Ca, nitrate, sulfate, and Cl were highest during winter, reflecting the use of road deicing salts. Residence time of rock salt on the road surface was less than 3 weeks. Routine analysis of groundwater samples in the aquifer beneath a brook receiving runoff showed increases in Ca, Mg, Cl, nitrate, and sulfate starting a few months before the official opening to traffic in July 1975. Sediment particle size was well-graded in the 0.1-2 mm size range (medium and coarse sand). Chemical analysis of suspended solids showed an association of chemical ions with the smaller sediment particles. Concentrations of ions (mg per liter) during non-salting periods were: K and Mg, < 5; Ca, 30-100; Na, 12-37; sulfate, 6-100; Cl, 22-75; and nitrate, 1.95-73.5. Nitrate was not affected by road salting but was influenced by farming activities. However, maximum concentrations (mg per liter) of the other ions were reached during salt application: K, 47; Mg, 42; Ca, 820; Na, 20,000; and Cl, 37,500. The first flush from a storm usually contained the highest levels of pollutants. The pollutant load was a function of antecedent dry days and quantity of rainfall. Pollution loads (in kg) per storm discharged into the receiving stream were: Na, 0.064-1025; K, 0.017-0.967; Ca, 0.087-21.02; Mg, 0.013-1.833; sulfate, 0.039-20.85; nitrate, 0.058-1.18; chloride, 0.83-11.95 and suspended solids, 0.06-43.65. Storm runoff contributed up to 78% of ionic contaminants and up to 48% of the suspended solids leaving the roadway and entering the brook. An undetermined amount of polluted road water was dispersed to the atmosphere as dry particles or spray. (Cassar-FRC)
W83-00461

MIXING AND TRANSPORT,
Georgia Inst. of Tech., Atlanta. School of Civil Engineering.
P. J. W. Roberts.
Journal of the Water Pollution Control Federation, (Literature Review Issue), Vol 54, No 6, p 763-769, June, 1982. 110 Ref.

Descriptors: *Mixing, *Transport, *Literature review, *Model studies, Streams, Rivers, Lakes, Reservoirs, Cooling ponds, Estuaries, Salt marshes, Coastal waters, Water currents, Current meters, Jets, Plumes, Stratified flow, Stratification, Fluid mechanics, Weather, Wind, Temperature, Path of pollutants.

A review of literature concerning various aspects of pollutant mixing and transport is presented. Streams and rivers were studied by means of models, including cells-in-series and advective-dispersion models applied to an observed release of dye into the Mississippi River, a new delay-difusion equation used for the calculation of logitudinal dispersion, analysis of contaminant dispersion by the ray method, a turbulence closure model, and a BOD model for dissolved oxygen in streams. One-, two-, and three-dimensional models were used by various authors to simulate conditions in lakes and reservoirs, while other papers discussed the effects of wind and temperature on transport and mixing in lakes and the design and flow and temperature distributions in cooling ponds. Three comprehensive papers covered the use and development of physical models of estuary processes, while one-dimensional models of estuarine transport predictions were studied in several works and two-dimensional models were used occasionally. The influences of turbulence and weather on estuarine transport were also covered. Studies in coastal waters included current meter and other field observations, as well as the influence of wind and other weather conditions on currents and circulation. Studies of jets and plumes covered non-buoyant jets issuing perpendicular to an ambient flow, laminar and turbulent round buoyant jets, three-dimensional buoyant jets,and thermal plumes. Stratified fluids were discussed in several model studies including models of the hydrodynamics of shallow, buoyant surface layers; of the deepening of a surface wind mixed layer in a stratified fluid; and an expression for the vertical velocity profile in stably-stratified two-dimensional channel flows. A review of publications on fluid mechanics principles relating to ecological problems and a comment on relationships between fluid mechanics and environmental issues were cited. (Gish-FRC)
W83-00478

NON-POINT SOURCES,
Browne (F. X.) Associates, Inc., Lansdale, PA.
F. X. Browne, J. B. Orr, T. J. Grizzard, and B. L. Weand.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 54, No 6, p 755-763, June 1982. 132 Ref.

Descriptors: *Nonpoint pollution sources, *Literature review, *Water pollution sources, *Water pollution control, Water management, Water sampling, Watersheds, Runoff, Agricultural runoff, Storm runoff, Urban runoff, Nutrients, Agriculture, Metals, Water quality, Model studies, Acid rain.

Recent publications concerning non-point sources of water pollution are reviewed. General aspects of the topic, such as water quality sampling networks and water pollution network models, are mentioned. Publications on the analysis and characteristics of non-point sources cover the sampling efficiency of the Coshocton Wheel; measurements of water-quality indicators such as suspended iron and lead, fecal coliforms, nitrogen, phosphorus, and potassium in watershed areas; the effects of canopies of corn, oats, and soybeans on the nutrient content of precipitation; the impact of wastewater sludge application to a watershed on metal content in runoff, groundwater, and soil; and urban non-point runoff. Water quality effects are discussed in studies of the fate of trace metals in a river-reservoir system, nutrient yields in runoff from small urban catchments, and phosphorus and chloride concentrations in runoff, streams, and lakes. Watershed studies also focus on nutrient levels but include works on suspended-sediment load, sediment runoff from river catchment areas, and trace metal mobility. Non-point source model research included a continuous simulation model applied to the Des Moines River, a modification of the SCS 'TR-20' runoff model for predictions of suspended sediment and bound-ion loadings, storage/tre to agricultural runoff. Non-point source management topics include local programs to manage storm water, urban and agricultural non-point pollution controls, water pollution control through river basin administration and financing agencies, and the effects of devices such as vegetative filters and concrete grids on runoff. Finally, papers on acid precipitation emphasize the altering of the chemistry and biology of streams and lakes and growth-limiting effects on plants. (Gish-FRC)
W83-00479

EVALUATION OF THE RIVER DIE-AWAY BIODEGRADATION TEST,
Missouri Univ.-Columbia. Dept. of Fisheries and Wildlife.
G. D. Wylie, J. R. Jones, and B. T. Johnson.
Journal of the Water Pollution Control Federation, Vol 54, No 8, p 1231-1236, August, 1982. 6 Fig, 1 Tab, 28 Ref.

Descriptors: Degradation, *Variability, *Phthalates, Organic compounds, Fate of pollutants, Di-2-ethylhexyl phthalate, Phthalic acid, *Biodegradation, *River Die-away Test, Rivers, *Missouri River, Suspended solids.

The river die-away (RDA) test for evaluating the biodegradability of chemicals in water was tested using labeled di-2-ethylhexyl phthalate (DEHP) and phthalic acid in Missouri River water. Test results were too variable and too dependent on laboratory conditions to reliably apply to the aquatic environment. Jars with river water (filtered and unfiltered) containing the compounds were allowed to stand in the dark on a laboratory bench top for 4 consecutive 35-day periods. Biodegradation of unfiltered DEHP was 11-78%; filtered DEHP, 4-28%. Biodegradation of phthalic acid was 66-92%. DEHP degradation was directly related to initial suspended solids but not to bacterial biomass or nutrient concentrations. (Cassar-FRC)
W83-00492

CONTAMINATION OF A GLACIAL AQUIFER AT PEASE AIR FORCE BASE, PORTSMOUTH, NEW HAMPSHIRE,
Geological Survey, Boston, MA.
E. Bradley.
Journal of the New England Water Works Association, Vol 96, No 2, p 109-126, 1982. 6 Fig, 1 Tab, 3 Ref.

Descriptors: *Solvents, *Groundwater pollution, *Storm drains, Path of pollutants, Fate of pollutants, *Trichloroethylene, Organic compounds,

Aquifers, Pease Air Force Base, Portsmouth, *New Hampshire, Wells, Water supply, Groundwater movement, Plumes, Tanks, Drains, Water pollution sources.

Trichloroethylene (TCE) at levels hazardous to health was detected in the groundwater supply of Pease Air Force Base, New Hampshire, in April 1977. This study was designed to identify the contaminating hydrocarbons and to define the nature, behavior, and extent of the contamination. TCE, used in large quantities at the base before 1973, was disposed of by storage in underground tanks, by burning, and by burial in landfills. In analysis of water samples collected June 1977 to May 1978, Haven well had the highest TCE concentrations, 40 to almost 400 micrograms per liter; ditch samples contained up to 60 micrograms per liter. Water sampling in the Haven well vicinity indicated that the contamination originated upgradient (northward) of the well. The precise pollution source was not determined but could have been any of the point sources or spills on ground and parking aprons and near storm drains. Scum within certain storm drains contained very high levels of TCE, suggesting that TCE concentrations in the northeast storm drain had been very high in the past. Some TCE contaminated groundwater has been recirculated by pumping from the Haven well and flow of the used water into storm drains. It was suggested that the Haven well should continue to be pumped, treating some of the water for consumption and using untreated water for aircraft washing. To close the Haven well would create a water supply problem and possibly allow migration of TCE contaminated groundwater to the unaffected wells further south. (Cassar-FRC)
W83-00495

GROUND-WATER POLLUTION INVESTIGATIONS IN THE GREAT OUSE BASIN. II-SOLID WASTE DISPOSAL,
D. J. Tester, and R. J. Harker.
Water Pollution Control, Vol 81, No 3, p 308-328, 1982. 5 Fig, 5 Tab, 27 Ref.

Descriptors: *Leachates, *Waste disposal, *Groundwater pollution, Landfills, Fate of pollutants, Organic compounds, Trace levels, Water pollution sources, Plumes, Legislation, Permits, Solid waste disposal, *Great Ouse Basin, *England.

The United Kingdom DOE's relaxation of requirements for permitting hazardous waste in landfills was welcomed by waste disposal authorities and guardedly received by water authorities. An investigation of groundwater quality at 3 domestic refuse sites strengthened the new approach by showing that pollution plumes around domestic landfills are restricted in extent and that attenuating mechanisms ameliorate the effects of leachate on groundwater quality, even where no substantial unsaturated zone exists. Although low levels of 66 organic micropollutants were detected in groundwater, they were not considered hazardous. Maximum levels of any single pollutant were estimated at 100 micrograms per liter; most were an order of magnitude lower. (Cassar-FRC)
W83-00507

THE RESORPTION OF ZINC FROM SCALES OF SEA TROUT (SALMO TRUTTA) DURING THE UPSTREAM SPAWNING MIGRATION,
Liverpool Univ. (England). Dept. of Zoology.
K. T. O'Grady.
Freshwater Biology, Vol 11, No 6, p 561-565, December, 1981. 1 Tab, 17 Ref.

Descriptors: *Fish, *Trace metals, *Water pollution effects, Zinc, Iron, Estuaries, Estuarine environment.

Zinc concentrations in the scales of unripe, premigratory sea trout and ripe, post-migratory sea trout about to spawn were compared to find out if the utilization of stored zinc that occurred in Oncorhynchus nerka also occurred in Salmo trutta. The age range, mean length and mean weight of the sea trout sampled were listed. No correlation was found between scale trace metal concentrations and the length, weight or age of the sea trout. The estuarine sea trout sampled in the study were heavier and longer than those from fresh water. Zinc was detected in all scale samples, and scales of sea trout from three sites in fresh water had similar mean values which were not significantly different from each other. Iron was not always detected in the scales, particularly in those from sea trout caught in fresh water, and the concentrations found were more variable than the zinc values. The concentration in scales from sea trout caught in freshwater was lower than in those caught in the estuary. The reclamation of trace metals from scales may represent the withdrawal of stored nutrients from body reserves to be used in gonad development and maturation. (Baker-FRC)
W83-00511

CONVECTION IN BOTTOM SEDIMENTS AND ITS ROLE IN MATERIAL EXCHANGE BETWEEN WATER AND SEDIMENTS,
Water Protection Association of Savo, Kuopio (Finland).
K. M. Lappalainen.
Hydrobiologia, Vol 86, No 1/2, p 105-108. January, 1982. 4 Fig, 3 Ref.

Descriptors: *Heat transfer, *Convection, *Sediments, Temperature, Water temperature, Lake sediments, Lakes, Fate of pollutants, Lake Kallavesi, Sammakkolampi, *Finland, Stratification, Thermal stratification, Interstitial water, Mass transfer, Eutrophic lakes, Littoral zone.

Temperature profiles of lake bottom sediments were measured in a small eutrophic pond, Sammokkolampi, and a large lake, Kallavesi, both in Finland. The constant deep sediment temperature, +6C, was reached at a depth of 2 m. The thermal stratification pattern in sediment was similar to that in water. Thermal gradients and seasonal variations of temperature were much greater in littoral sediments than in profundal sediments. Convection currents in the sediments were most prevalent during spring and summer overturn when the density of overlying water was less than that of the interstitial water. Some convection was noticeable in winter. Duration and magnitude of convection depended on warming and cooling rates. These currents may be important in transfer of pollutants and other substances from the sediments to the water. (Cassar-FRC)
W83-00531

HYDROLOGIC EFFECTS ON HIGHWAY-DEICING CHEMICALS IN MASSACHUSETTS,
Geological Survey, Boston, MA. Water Resources Div.
L. R. Frost, Jr., S. J. Pollock, and R. F. Wakelee.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: $8.00 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 81-209, 1981. 56 p, 26 Fig, 12 Tab, 26 Ref.

Descriptors: *Highways, *Deicers, *Sodium chloride, *Surface runoff, *Water quality, Path of pollutants, Infiltration, Solute transport, Drainage systems, Flow separation, Groundwater recharge, Specific conductivity, Data collections, Hydrologic models, Regression analysis, *Massachusetts, Highway deicing chemicals.

Methods of estimating annual mean and annual maximum chloride concentrations and sodium concentrations in streams were developed using multiple and simple linear regression techniques and data collected during the 1972-77 water years. Independent variables are easily obtainable parameters such as total salt application within a basin, annual precipitation, and drainage basin characteristics. Methods for obtaining gross estimates of chloride loads and sodium loads from salt-application data and estimates of nonhighway-related chloride and sodium were suggested. A chloride budget was calculated for a small drainage basin containing a section of interstate highway. The chloride budget was described in terms of the percentages in direct runoff to the stream, in ground-water discharges to the stream, in storage in the ground, and in the amount unaccounted for. Attempts were made to relate chloride concentrations in ground water adjacent to highways to quantities of salt applied to the highways on an annual basis, annual precipitation, depth of the wells below land surface, depth of wells below the water table, and distance of well from edge of pavement. Little correlation was observed between annual salt-application values and annual mean chloride concentrations in ground water near highways. The irregular distribution of highway runoff, due to topographic differences between sites, and variations in salting and runoff during individual storm events seem to affect correlation between quantities of salt applied and chloride concentrations in ground water near highways. (USGS)
W83-00558

LOW FLOW WATER CHEMISTRY IN FORESTED AND PASTURE CATCHMENTS, MAWHERAITI RIVER, WESTLAND,
Forest Research Inst., Christchurch (New Zealand).
M. P. Mosley, and L. K. Rowe.
New Zealand Journal of Marine and Freshwater Research, Vol 15, No 3, p 307-320, 1981. 5 Fig, 7 Tab, 42 Ref.

Descriptors: *Water analysis, *Rivers, Mawheraiti River, *New Zealand, Chemical analysis, Incineration, Stream flow, Calcium, Magnesium, Sodium, Potassium, Nitrates, Phosphates, Ammonium, Trace metals, Catchments, Forest watershed, Water quality, Forest management, Water pollution sources.

Water chemistry was investigated at a number of locations in the Mawheraiti River catchment in Westland, South Island, New Zealand. Subcatchment areas range up to 78 square kilometers, and land cover includes indigenous forests, pasture and scrub. Variations were noted in water chemistry which may be related to season, discharge, lithology and land use. However, perhaps the most striking feature of the low flow water chemistry of the river was its purity. Total solute concentrations, determined by evaporation to dryness, exceeded 50 mg/liter in only a few water samples, and perhaps 15 mg/liter of this could have been non-filterable organic colloidal matter. Irrespective of land use or management, under low flow conditions concentrations of individual ions did not approach the safe limits for human or animal consumption, except for limited periods immediately after slash-burning in a clearfelled catchment. In particular, nitrate and phosphate, the nutrients that are usually considered to cause water quality problems, were generally below 0.05 mg/liter. Greater concentrations in catchments subjected to clearfelling and slash-burning were rapidly diluted downstream. (Baker-FRC)
W83-00568

THE MAIN APPROACHES TO THE STUDY OF THE CYCLE OF BIOLOGICAL ELEMENTS IN THE DNIEPER RESERVOIRS,
Akademiya Nauk URSR, Kiev Inst. Hidrobiologii.
A. I. Denisova, and Ye. P. Nakhshina.
Hydrobiological Journal, Vol 17, No 2, p 94, 1981.

Descriptors: *Nutrients, *Bottom sediments, *Metals, Fate of pollutants, Dnieper River, *USSR, Trace metals, Chemical reactions, Sediments, Lake sediments, Self-purification, Water pollution sources.

Studies of the fate of nutrients and trace metals in the reservoirs of the Dnieper chain consider all factors, both allochthonous and autochthonous. Some of these factors are the position of the reservoir in the chain, its age, its morphology, anthropogenic input, the role of suspended matter and bottom sediments, and higher water plants. Bottom sediments play an important role in the fate of metals and nutrients. In some cases they promote self-purification; in others they are a source of pollution through resuspension and chemical reactions (oxidation-reduction and complex formation). (Cassar-FRC)
W83-00599

BIODEGRADATION OF CELLULOSE IN BOTTOM SEDIMENTS OF LAKE BAIKAL,

Irkutskii Gosudarstvennyi Univ. (USSR). Lake Baikal Biological Station.
E. A. Maksimova, V. N. Maksimov, and G. N. Kolesnitskaya.
Hydrobiological Journal, Vol 17, No 3, p 46-52, 1981. 4 Fig, 1 Tab, 8 Ref.

Descriptors: *Cellulose, *Pulp wastes, *Biodegradation, Fate of pollutants, *USSR, *Lake Baikal, Lakes, *Lake sediments, Cellulase activity, Sediments, Degradation, Bottom sediments, Deep water, Pulp and paper industry.

Biodegradation of cellulose from pulp mill effluents and from natural sources was studied in sediments from Lake Baikal. Cellulase activity was used as the indicator of ability of microorganisms to decompose vegetable cellulose. High, but variable, cellulase activity values were found in the zone of discharge from the pulp mill: 5.6-372.8 micrograms glucose per g dry sediment in winter and 16.0-378.0 micrograms glucose per g dry sediment in summer. Cellulose content in the sediment in 1976-78 was 20-45% of total organic matter. Numbers of cellulose degrading bacteria ranged from 900 to 12,000 per g dry sediment. In unpolluted zones away from the discharge, cellulase activity was fairly uniform, averaging 100 micrograms glucose per g dry sediment. Sediments from great depths, 1050-1100 meters, had cellulase activities of 99-134 micrograms glucose per g dry sediment. High lignin concentrations depressed cellulase activity in some regions of the lake. (Cassar-FRC)
W83-00600

THE FORMS IN WHICH MANGANESE MIGRATES IN THE WATER OF THE DNIEPER AND THE DESNA,
Akademiya Nauk URSR, Kiev. Inst. Hidrobiologii.
P. N. Linnik.
Hydrobiological Journal, Vol 17, No 2, p 95-96, 1981. 1 Tab.

Descriptors: *Manganese, *Chelation, *Seasonal variation, Fate of pollutants, Rivers, Dnieper River, Desna River, Phytoplankton, *USSR.

The seasonal dynamics of manganese in water of the Dnieper and Desna Rivers were studied using a chemical fluorescence procedure in conjunction with membrane filtration, electrodialysis, electromigration, and gel chromatography. In winter and spring, when organic matter levels and dissolved oxygen concentrations were minimum (1.2 mg per liter oxygen in the Dnieper and 0.4 mg per liter in the Desna) dissolved Mn was dominant (60% in Dnieper water and 80% in Desna water). Under oxidative conditions in spring dissolved Mn decreased sharply through precipitation as Mn02. Levels of Mn complexes were higher in the organic-rich Dnieper Water than in Desna water. Desna Mn complexes were mostly 1500-5000 molecular mass and less. Dnieper Mn complexes ranged in molecular mass from 500 to over 150,000. The concentration of Mn of the 500-5000 size was minimal during intensive growth of water plants. The concentration of low molecular mass compounds (< 300) increased as the phytoplankton died off in late August and September. (Cassar-FRC)
W83-00601

ECOLOGICAL ASSESSMENT OF WATER QUALITY IN THE ESTUARINE REGION OF THE DANUBE,
Central Research Inst. on the Multi-purpose Use of Water Resources, Kiev (USSR).
A. I. Babarik, A. I. Sergiyenko, and A. P. Chernyavskaya.
Hydrobiological Journal, Vol 17, No 2, p 97, 1981.

Descriptors: Metals, *Estuarine environment, *Danube River estuary, Rivers, Water quality, Fate of pollutants, *Heavy metals, *USSR.

Water quality in the lower reaches of the Danube River on the USSR border is better than in the more industrialized upper reaches. However, at Reni (70 miles from the Black Sea) heavy metals concentrations are close to maximum permissible limits. Heavy metals gradually decrease downstream to a low of 10-30% of maximum permissible limits at Kilya (20 miles from the Black Sea). This reduction is caused by absorption by plant material, rocks, soil, sediment, and groundwater. Removal of suspended matter would decrease metals levels. (Cassar-FRC)
W83-00602

LARGE SUBSURFACE SEWAGE DISPOSAL SYSTEMS,
M. M. Ali, and H. T. Chan.
Research Publication No 89, Ministry of the Environment, Toronto, Canada, April 1982. 129 p, 64 Fig, 19 Tab, 38 Ref. 1 Append.

Descriptors: *Mathematical models, *Groundwater pollution, *Wastewater disposal, *Surface-groundwater relations, *Sewer systems, Subsurface drainage, Subsurface drains, Groundwater, Infiltration coefficient, Surface water, Water table, Leaching, Infiltration, Hydraulic gradient, Model studies, Mathematical equations.

A field investigation was conducted to determine the impact of a large (0.54 ha) subsurface sewage disposal system on groundwater. Groundwater mounding (GM) as influenced by soil conditions, hydraulic loading rate, climatic, and natural environmental factors could be predicted by either of two mathematical models. An estimate of the rise in water table (WT) due to the infiltration of surface water can be made on a statistical basis according to the weather data and at least 1-year of observational data on natural WT fluctuations. The degree of maximum rise should equal the sum of the rise caused by hydraulic loading and that due to surface infiltration. Comparing groundwater chemical levels before and after subsurface disposal, groundwater under and near the leaching bed approached levels of the feed. Maximum contaminant levels were within one meter below the WT. GM increased the contaminant velocity due to increased hydraulic gradient. Nitrate, chloride, sodium, calcium, sulfate, hardness, and conductivity were measured to assess the groundwater contamination. A modified Langmuir equation was used to determine the absorption capacity of the soil. (Zielinski-MAXIMA)
W83-00626

MONITORING TO DETECT GROUNDWATER PROBLEMS RESULTING FROM ENHANCED OIL RECOVERY,
Energy Resources Co., Inc., Cambridge, MA.
R. Beck, B. Aboba, D. Miller, and I. Kaklins.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-119074, Price codes: A07 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S2-81-241, January 1982. 8 p, 4 Fig, 6 Tab. 68-03-2648.

Descriptors: *Monitoring, *Groundwater pollution, *Oil recovery, *Water pollution sources, Statistical analysis, Oil pollution, Oil industry, Mathematical models, Water pollution control, Oil spills.

All enhanced oil recovery (EOR) technologies involve potential groundwater concerns. Those technologies that require injection of chemicals into the reservoir or fracturing of formations hold the most potential for contamination. In situ combustion is also of particular concern because of the range of chemicals that are formed during the subsurface combustion process. A four-stage monitoring program was developed to detect groundwater contamination events that could result from EOR projects. The monitoring system design is based on a statistical analysis evolving from a series of equations that model subsurface transport of EOR spills. Results of the design include both spatial and frequency monitoring intervals that depend on properties of the local geology and dispersion characteristics of the potential contaminants. The four stages of monitoring are: develop baseline; monitor trend; specifically evaluate flagged problems; and assess effectiveness of controls. Selection of measures to be sampled is based on a review of the identity of likely contaminants, on the available sample and analysis procedures, and on the cost and time constraints on analysis. Comprehensive monitoring for each potential pollutant requires extensive budgetary commitments, while the measurement of indicator parameters rather than specific chemicals provides less detailed and precise information, but is a more certain way of obtaining useful returns for a given level of investment. The number of independent variables in the analysis dictate that EOR monitoring systems be designed on a site-specific basis. (Moore-SRC)
W83-00635

SORPTION OF ZINC BY LAKE MICHIGAN SEDIMENTS--IMPLICATIONS FOR ZINC WATER QUALITY CRITERIA STANDARDS,
Wisconsin Univ.-Stevens Point. Dept. of Chemistry.
G. E. Nienke, and G. F. Lee.
Water Research, Vol 16, No 9, p 1373-1378, September, 1982. 8 Tab, 12 Ref.

Descriptors: *Zinc, Sediments, *Sorption, Fate of pollutants, *Water quality standards, *Lake Michigan, *Lake sediments, Suspended sediments, Bottom sediments, Metals, Heavy metals.

The uptake and release of zinc from Lake Michigan sediments was investigated under aerobic and anaerobic conditions. Zn release was very pH dependent under aerobic conditions. Zn levels in water overlying a silty-clay sediment with moderate Zn content were 19-21 micrograms per liter at pH 6.0-6.1 and 9.0 micrograms per liter at pH 7.9; in a sandy-clay, low Zn sediment, 36 micrograms per liter at pH 6.0 and 3-11 micrograms per liter at higher pH. These sediments released Zn as pH was lowered. However, once the pH was lowered the sorption release mechanism was altered so that Zn release did not occur at pH > 7.0. Under anaerobic conditions no appreciable Zn was released from the sediments during 2 weeks. If any Zn was released, it may have precipitated as the sulfide. Adding Zn to water in aerated systems showed the sediments' limited capacity to absorb more Zn, in this case 1.2-1.5 mg Zn per kg sediment. Treatment with 0.25 M HCl released all Zn bound in the sediment. The likely form of Zn in the sediment was Zn(OH)2, ZnC03, or loosely bound by organic particulate matter. Since Zn is essentially irreversibly adsorbed onto aquatic sediments, the validity of the U.S. EPA water quality criterion on Zn is questioned. This criterion is based on total recoverable Zn concentrations. It is recommended that state water quality standards consider the concentrations of suspended matter in the water because discharges of Zn into relatively turbid water would have much less impact on aquatic organisms than discharges into clear waters. (Cassar-FRC)
W83-00643

DISTRIBUTION OF ENTEROVIRUSES IN SEDIMENTS CONTIGUOUS WITH A DEEP MARINE SEWAGE OUTFALL,
Miami Univ., Fl. Dept. of Microbiology.
G. E. Schaiberger, T. D. Edmond, and C. P. Gerba.
Water Research, Vol 16, No 9, p 1425-1428, September, 1982. 3 Tab, 22 Ref.

Descriptors: *Viruses, *Bacteria, *Outfalls, *Sediments, Coliforms, Beaches, Miami Beach, *Florida, Seawater, Marine sediments, Enteroviruses, Wastewater disposal.

The distribution of viruses and indicator bacteria from the Miami Beach, Florida, raw sewage outfall 3.6 km from shore and 44 m deep was studied. No bacteria or viruses were found in water samples collected further than 200 m from the outfall boil. Organisms survived at greater distances in sediments. Bacteria were isolated from sediment samples taken up to 400 m from the outfall boil. Viruses were detected in 2 of 5 sediment samples at concentrations of 15 and 30 PFU per liter at the bathing beach directly onshore from the outfall pipe, 3640 m from the outfall boil. Virus levels in sediments decreased with distance from the pipe outlet to the beach: 78-112 PFU per liter at the seaward end of the pipe at 3640 m from shore, 18-

23 PFU per liter at 3200 m from shore, and 0-2 PFU per liter at 100 m from shore. (Cassar-FRC)
W83-00645

THE USE OF URIC ACID AS A METHOD OF TRACING DOMESTIC SEWAGE DISCHARGES IN RIVERINE, ESTUARINE AND COASTAL WATER ENVIRONMENTS,
Plymouth Polytechnic (England).
For primary bibliographic entry see Field 5A.
W83-00646

INVESTIGATION ON THE MICROBIOLOGY OF THE SAAR RIVER (UNTERSUCHUNG ZUR MICROBIOLOGIE DER SAAR),
Universitaet des Saarlandes, Saarbruecken (Germany, F.R.). Dept. of Microbiology.
M. Schneider, U. Zaiss, and H. Kaltwasser.
Zeitschrift fur Wasser und Abwasser Forschung, Vol 14, No 2, p 31-37, 1981. 6 Fig, 2 Tab, 37 Ref. English Summary.

Descriptors: *Microbiological studies, Rivers, *Saar river, *Water pollution effects, Oxygen, Dissolved oxygen, Oxygen requirements, Water temperature, Effluents, Industrial wastewater, Path of pollutants, *France, *West Germany, Navigation canals, River flow, Denitrification, Nitrogen, Ammonium, Nitrate, Nitrite, Saprophytic bacteria, Tributaries, Rossel river, Artificial watercourses, Sulfur, Sulfates, Water quality.

Longitudinal profiles of the water quality of the Saar River (France and West Germany) are discussed. In 1975-6 the river was canalized for shipping from Sarregemines to Ensdorf and dammed as far as Mettlach. This was also the most heavily polluted zone. The slow flow in the dammed river led to a reduced oxygen input from the atmosphere, and this was accompanied by increased oxygen consumption in the water due to domestic and industrial effluents. The longitudinal profiles showed that the temperature of the river rose from the source to the mouth, with a maximum of 24C at Lisdorf (flow km 159) in the central, polluted section. Variations in temperature were not seasonal but depended mainly on inflow of cooling waters and heated effluents. Dissolved oxygen content declined from source to mouth, with particularly low levels in the canalized zone (e.g., 10.2% saturation below Sarrebourg). The concentration of saprophytic bacteria in August 1975 was 8400 cells/ml at the source, 2 million at flow km 152, in the order of 1 million at Lisdorf, and then declined downstream to 56,000 at Konz (km 240). Sulfate content was low (13.0-21.0 mg/l) at the source and extremely high in the canalized section (e.g., 183.9 mg/l at km 186); this was partially due to pollution from the coal mining industry and from intensive agriculture. Nitrogen compounds followed a similar trend, with ammonium reaching a maximum of 21.66 mg/l N below the mouth of the Rossel. The Rossel contributed greatly to the pollution of the Saar. Self-purification occurred downstream of the canalized zone. (Gish-FRC)
W83-00649

INTERLABORATORY TESTING OF THE LEACHABILITY OF WASTES AND SLUDGES (RINGVERSUCHE ZUR BESTIMMUNG DER ELUIERBARKEIT VON ABFALLEN UND SCHLAMMEN MIT WASSER),
F. Von Ammon, and F. Dietz.
Zeitschrift fur Wasser und Abwasser Forschung, Vol 14, No 2, p 51-60, 1981. 11 Fig, 9 Tab, 4 Ref. English Summary.

Descriptors: *Leaching, *Testing procedures, *Groundwater pollution, *Sludge disposal, Waste disposal, Laboratories, Surface water, Standards, Elution, Solubility, Waste dumps.

A working committee on sludge and sediments, part of the working group on water chemistry of the Society of German Chemists, developed a method to predict the endangerment of ground- and surface waters through the leaching of deposited wastes. Several interlaboratory experiments were performed to test the method and its reproducibility. The materials analyzed were ash from a municipal refuse incinerator, ash from a sludge treatment incinerator, and dilute sludge from the galvanizing industry with a relatively high heavy-metal content. Within the standard method, adjustments should be made according to the material to be tested; for example, plastic elution tubes should not be used for materials that could cling to the walls by sorption. Reducing the fragment size of the waste should be avoided as far as possible, and mixing during elution should be done sparingly. To achieve reproducible results, the proportion of dry waste to elution water should be held constant; in general, the ratio 100 g dry waste to 1 l elution fluid is used. For dilute sludge, the solid and liquid portions should be analyzed separately. Clean filtrate should be used for each elution step. The prediction of endangerment through leaching consists of the concentration of various substances in the waste; the interlaboratory experiments showed that concentrations can rise with multiple leaching, and this should be examined. Some substances leach over long periods; this is not so dangerous if large amounts leach at first with a rapid reduction thereafter. Multiple elution resolves the question of solubility of a substance; weakly soluble substances leach uniformly, highly soluble ones mainly on the first elution. At each step, the leachate is to be compared with the original mass of the material tested. While the method is successful in determining the leachability of substances with water in the laboratory, it cannot give quantitative information on the behavior and fate of wastes under the variable conditions of a refuse tip. (Gish-FRC)
W83-00650

HYDROGEOCHEMICAL PROSPECTING OF ORE-DEPOSITS, DEMONSTRATED ON SOME WATER ANALYSES FROM PERU. (HYDROGEOCHEMISCHE PROSPEKTION VON ERZLAGERSTATTEN DARGESTELLT ANHAND EINIGER WASSERANALYSEN AUS PERU),
Technische Univ., Munich (Germany, F.R.). Lehrstuhl fuer Hydrochemie und Hydrogeologie.
P. Udluft.
Zeitschrift fur Wasser und Abwasser Forschung, Vol 14, No 2, p 38-43, 1981. 3 Fig, 7 Tab, 4 Ref.

Descriptors: Rivers, *Water analysis, *Chemical properties, *Ore deposits, Lead, Zinc, Copper, Cadmium, *Heavy metals, Water sampling, Mineral prospecting, Drinking water, *Peru, Mineral water, Sulfates, Path of pollutants, Pollutant identification.

In order to investigate the usefulness of hydrogeochemical analyses for mineral prospecting, water samples were evaluated from the Rio Rimac, Peru, which in its headwaters flows through one of the most significant sulfidic deposits of zinc, copper, and lead in South America. Above the deposit, copper, zinc, and cadmium could not be detected in the river water, while lead was present in a concentration of 46.0 micrograms/l. The lead was thought to emanate from an ore smelting works 35 km to the east, being transported to the Rimac by easterly winds. A sample taken within the deposit area showed copper, zinc, cadmium, and lead at levels of 45.0, 428.0, 3.42, and 68.0 micrograms/l, respectively. Another sample taken about 100 km downstream and 3,700 m lower than the second revealed that the zinc content was reduced 20-fold in comparison with the second sample (21.0 micrograms/l), the copper content was reduced by half (20.0 micrograms/l), and cadmium was now undetectable, while the lead level remained the same. The high lead level indicates that lead is transported differently from other heavy metals. Sulfate concentration was 84.0 mg/l in the first sample, 170.0 mg/l in the second, and 16.0 in the third. When drinking water from the city of Lima was sampled, copper, zinc, and lead were found in concentrations of 25.0, 13.0, and 65.0 micrograms/l, respectively (cadmium was not detected). This water corresponds in content to that of the third sample. When these samples were compared with samples of water from ore-free areas of Peru, the usefulness of water analysis as an aid in prospecting was seen. (Gish-FRC)
W83-00674

SEWAGE PLUME IN A SAND AND GRAVEL AQUIFER, CAPE COD, MASSACHUSETTS,
Geological Survey, Boston, MA. Water Resources Div.
D. R. LeBlanc.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver CO 80225, Price $5.00 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 82-274, 1982. 35 p, 18 Fig, 2 Tab, 34 Ref.

Descriptors: *Secondary wastewater treatment, *Land disposal, *Groundwater pollution, *Unconfirmed aquifers, Sand aquifers, Solute transport, Infiltration, Wastewater lagoons, Groundwater movement, Water quality, Chemical analysis, *Massachusetts, Cape Cod, Contaminant plume.

Secondarily treated domestic sewage has been disposed of to a sand and gravel aquifer by infiltration through sand beds at Otis Air Force Base, Massachusetts, since 1936. The disposal has formed a plume of contaminated ground water that is more than 11,000 feet long, is 2,500 to 3,500 feet wide and 75 feet thick, and is overlain by 20 to 50 feet of uncontaminated ground water derived from precipitation. The distributions of specific conductance, temperature, boron chloride, sodium, phosphorus, nitrogen, ammonia, nitrate, dissolved oxygen, and detergents are used to delineate the plume. The center of the plume contains up to 2.6 milligrams per liter detergents as MBAS (methylene blue active substances), 0.4 milligram per liter boron, 20 milligrams per liter ammonia-nitrogen, and specific conductance as high as 405 micromhos per centimeter. Corresponding levels in uncontaminated ground water are less than 0.1 milligram per liter detergents, less than 0.1 ammonia-nitrogen, less than 0.05 milligram per liter boron, and less than 80 micromhos per centimeter specific conductance. Chloride, sodium, and boron concentrations seem to be affected only by hydrodynamic dispersion. Phosphorus movement is greatly retarded by sorption. Detergent concentrations exceed 0.5 milligram per liter from 3,000 to 10,000 feet from the sand beds and reflect the use of nonbiodegradable detergents from 1946 through 1964. The center of the plume as far as 5,000 feet from the sand beds contains nitrogen as ammonia, no nitrate, and no dissolved oxygen. Ammonia is oxidized to nitrate gradually with distance from the center of the plume. (USGS)
W83-00688

5C. Effects Of Pollution

HEALTH EFFECTS ASSOCIATED WITH WASTEWATER TREATMENT AND DISPOSAL,
Cincinnati, Ohio, Health Effects Research Lab., Cincinnati, OH.
N. E. Kowal, and H. R. Pahren.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 54, No 6, p 677-687, June, 1982. 110 Ref.

Descriptors: *Wastewater treatment, *Wastewater disposal, *Public health, *Reviews, Diseases, Incineration, Composting, Bacteria, Viruses, Pathogens, Parasites, Sludge, Aquaculture, Metals, Toxicity, Organic compounds, Fate of pollutants, Water pollution effects, Water reuse, Renovated water, Septic tanks, Industrial wastewater, Sewer systems, Land disposal.

Health effects associated with wastewater treatment, sludge incineration, sludge composting, land application of wastewater and sludge, wastewater aquaculture, septic tanks and other on-site systems, water reuse, and industrial wastewater were reviewed. Potential hazards of working and living near wastewater treatment plants were not severe. However, some bacteria were detected in downwind aerosols. Coliform populations exhibited an increased incidence of antibiotic resistance factor over several years. Incineration presented no serious health hazards. Composted sludge can be a source of exposure to Aspergillus, viruses, bacteria, and parasites if not properly processed. Land application of wastewater and sludge was the subject of many investigations. Some findings indicated little risk to human and animal health or to the environment when proper treatment and application techniques were followed. In contrast, other work

indicated adverse effects resulting from an accumulation of heavy metals in animal and plant tissues and the possible presence of Salmonella and other pathogens. Improper wastewater treatment and disposal lead to waterborne parasitic diseases, increases in mosquito populations in areas of wastewater spray irrigation, and bacterial infections. The survival of pathogens was studied with simulation models and by sampling wastewat er sludges and soils. Some investigations concluded that there was little risk of disease transfer in normal wastewater treatment and disposal. Others pointed out survival of parasitic cysts and ova, Salmonella and other bacteria, and viruses. Wastewater and effluents used in aquaculture should be carefully monitored before application, since aquatic plants and animals can concentrate pathogens and toxic elements. (Cassar-FRC)
W83-00371

EFFECTS OF 2,4-D ON NON-TARGET SPECIES IN KERR RESERVOIR,
Oral Roberts Univ., Tulsa, OK. Dept. of Natural Science.
For primary bibliographic entry see Field 3B.
W83-00378

ECOLOGICAL CONSEQUENCES OF LONG-TERM EXPOSURE OF ANABAENA VARIABILIS (CYANOPHYCEAE) TO SHIFTS IN ENVIRONMENTAL FACTORS,
Rensselaer Polytechnic Inst., Troy, NY. Dept. of Biology.
C. D. Collins, and C. W. Boylen.
Applied and Environmental Microbiology, Vol 44, No 1, p 141-148, July, 1982. 6 Fig, 2 Tab, 35 Ref.

Descriptors: *Algal blooms, *Light intensity, *Adaptation, Seasonal variation, Chlorophylla, Phytoplankton, *Anabaena variabilis, Photoadaptation, Photosynthesis, *Cyanphyta.

The time course for adaptation of the blue-green alga Anabaena variabilis to specific environmental conditions was measured to better understand the ecological consequences of environmental variability. The algal cultures were exposed to different light intensities, and the time course of photoadaptation was measured by photosynthetic rate and changes in pigmentation. The findings showed that successful adaptation was limited to a narrow range of temperature and light combinations, outside of which range adaptation was not attained. This not only provides a possible explanation for the decline of blooms, but may also provide an explanation of why blue-green algae do not normally develop bloom population densities. It is suggested that it may be possible to predict declines in algal blooms as a result of synoptic weather patterns of hydrodynamic influences. (Baker-FRC)
W83-00391

FACTORS AFFECTING THE TOXIC EFFECT OF TIN ON ESTUARINE MICROORGANISMS,
Cornell Univ., Ithaca, NY. Dept. of Agronomy.
L. E. Hallas, J. S. Thayer, and J. J. Cooney.
Applied and Environmental Microbiology, Vol 44, No 1, p 193-197, July, 1982. 1 Fig, 3 Tab, 30 Ref.

Descriptors: *Tin, *Estuarine environment, *Microorganisms, *Toxicity, *Heavy metals, Water pollution effects, Sediments, Gelatin, Silica gel, Cadmium, Copper, Lead, Nickel, Zinc, Serine, Humic acids, Sulfates, Nitrates, Chlorides, Speciation, *Maryland.

The influence of organic and inorganic ligands on the toxic effect of tin and other metals on estuarine microorganisms was investigated. The use of gelatin as a gelling agent decreased the apparent toxicity of tin, and toxicity was markedly reduced in medium solidified with silica gel. No evidence was obtained which suggested that toxic agar-tin complexes were involved. Cd, Cu, Pb, Ni, and Zn exhibited similar toxicity patterns. Therefore, toxicity levels determined in the laboratory should be extrapolated to the environment with caution. The addition of cysteine to the medium had no effect on tin toxicity. Serine or 3-hydroxyflavone enhanced toxicity, while humic acids or gelatin inhibited toxicity. Replacement of S04(2-1) with N03(-) did not change tin toxicity. However, the replacement of C1(-) with N03(-) decreased tin toxicity. Thus the toxic effect(s) of tin depend as much on the chemical speciation of the metal as on the total concentration of the metal in the medium. (Baker-FRC)
W83-00393

PHOSPHORUS REDUCTION IN A MAN-MADE LAKE BY MEANS OF A SMALL RESERVOIR ON THE INFLOW,
Hydraulic Research Inst., Prague (Czechoslovakia).
For primary bibliographic entry see Field 5G.
W83-00396

PHOSPHORUS EXPORT FROM COASTAL PLAIN DRAINAGE INTO THE PEEL-HARVEY ESTUARINE SYSTEM OF WESTERN AUSTRALIA,
Western Australia Dept. of Conservation and Environment, Perth.
For primary bibliographic entry see Field 5B.
W83-00408

INTERTIDAL COMMUNITY OFFSHORE FROM THE WERRIBEE SEWAGE-TREATMENT FARM: AN OPPORTUNISTIC INFAUNAL ASSEMBLAGE,
Interstate Electronics Corp., Anaheim, CA. Ocean Sciences Dept.
J. H. Dorsey.
Australian Journal of Marine and Freshwater Research, Vol 33, No 1, p 45-54, 1982. 1 Fig, 6 Tab, 29 Ref.

Descriptors: *Wastewater pollution, *Organic matter, *Invertebrates, Water pollution effects, Port Phillip Bay, Werribee, *Australia, Nutrients, Intertidal areas, Species diversity, Benthic fauna, Sediments.

A survey was conducted of the macrofauna and its sediment habitat in areas of intense predation by wading birds in the intertidal area of the Port Phillip Bay ecosystem, Victoria, Australia. Species diversity was low and abundance very high in the upper intertidal sediments between 2 municipal effluent drains emptying into the bay. Sampling done in late spring 1979 showed opportunistic species such as polychaetous annelids, corophiid amphipods, and bivalve mollusks. Deposit feeders comprised 38.7% of total individuals; deposit-suspension feeders, 27.7%; suspension feeders, 33.4%; and omnivores, carnivores, and unknown, each 0.1%. Number of species found at each station was 14 to 22. Densities of individuals at the drains were over 300,000 per sq m; between the 2 drains, 100,000-300,000 per sp m. Juveniles contributed significantly to the macrofaunal abundance. The sediments consisted of 2.7% organic matter, 30.7% shell debris, 6.3% mud, and the remainder fine to medium sand. (Cassar-FRC)
W83-00409

PHOSPHORUS AND NITROGEN LOADS IN WATERS ASSOCIATED WITH RIVER MURRAY NEAR ALBURY-WODONGA, AND THEIR EFFECTS ON PHYTOPLANKTON POPULATIONS,
Adelaide Univ. (Australia). Dept. of Zoology.
K. F. Walker, and T. J. Hillman.
Australian Journal of Marine and Freshwater Research, Vol 33, No 2, p 223-243, 1982. 9 Fig, 8 Tab, 20 Ref.

Descriptors: *Nutrients, *Phytoplankton, *Streamflow, Eutrophication, Lakes, Water pollution effects, Turbidity, Murray River, *Australia, *Phosphorus, *Nitrogen, Nitrates, Light penetration, Algal growth.

Phosphorus and nitrogen loads were measured during 1974-77 in the Murray River system, Australia, including some of its tributaries and two impoundments. The purpose was to document nutrient loads at different river flows and assess the trophic status of the impoundments. Nutrient loads varied directly with streamflow. Mean total P loads (in kg per day) measured at several stations were 138-1473 in the wet years 1974-75 and 42-496 in the dry years 1976-77. Mean total TKN loads (in kg per day) were 1121-19,983 in 1974-75 and 723-333 in 1976-77. Nitrate loads (kg N per day) were 148-2487 in 1974-75 and 39-652 in 1976-77. Phytoplankton biomass (average below 2000 cu mm per cu m) did not correspond to the variations in nutrient concentrations. Growth was probably restricted by low light penetration caused by high turbidities during high flow periods. Results indicated that continued growth in the urban population at Albury-Wodonga on the Murray would contribute to nuisance algal blooms during low flow periods. (Cassar-FRC)
W83-00410

BIOACCUMULATION OF ORGANOCHLORINES BY YEARLING COHO SALMON (ONCORHYNCHUS KISUTCH WALBAUM) FED DIETS CONTAINING GREAT LAKES' COHO SALMON, AND THE PATHOPHYSIOLOGICAL RESPONSES OF THE RECIPIENTS,
Guelph Univ. (Ontario). Dept. of Zoology.
J. F. Leatherland, and R. A. Sonstegard.
Comparative Biochemistry and Physiology C: Comparative Pharmacology, Vol 72C, No 1, p 91-99, 1982. 6 Tab, 28 Ref.

Descriptors: Fish, *Bioaccumulation, *Pesticides, Fate of pollutants, Water pollution effects, Accumulation, *Salmon, *Great Lakes, Lakes, Polychlorinated biphenyls, DDE, DDT, *Organochlorine pesticides, Chlordane, Mirex, Lindane, Lake Ontario, Lake Erie, Lake Michigan.

Yearling coho salmon were fed for 47 weeks on diets containing flesh from sexually mature adult coho salmon from Lakes Ontario, Erie, and Michigan. Chopped coho salmon from the Pacific Ocean and a commercial trout chow served as control diets. The total organochlorine burdens (in micrograms per kg) in the diets were Lake Michigan salmon, 8277; Lake Ontario, 7509; Lake Erie, 2630; Pacific Ocean, 199; and trout chow, 187. Polychlorinated biphenyls ranged from 70.1 to 82.9% of the total organochlorines in the fish diets. Also present were DDE (10.5-19.9%), chlordane (5.1-2.4%), DDD (6.3-2.5%), mirex, BHC, and lindane. The total accumulation of organochlorines in the young salmon was directly proportional to the total organochlorine levels in their diets. Total accumulated organochlorine levels (micrograms per g) in fish fed the various diets were: Ontario, 6.6; Erie, 2.2; Michigan, 8.8; Pacific Ocean, 0.3; and trout chow, 0.2. Ratios of organochlorine consumed to organochlorine accumulated in fish tissue were 0.18 for the Great Lakes fish diet, 0.29 for the Pacific Ocean diet, and 0.39 for the trout chow. Compared with controls, fish fed the Great Lakes salmon flesh showed significant differences in thyroid physiology, hematocrit, liver structure, and interrenal gland activity. (Cassar-FRC)
W83-00418

EUTROPHICATION,
Colorado Univ., Boulder.
A. J. Medine, and D. B. Porcella.
Journal of the Water Pollution Control Federation, (Literature Review Issue) Vol 54, No 6, p 770-778, June, 1982. 116 Ref.

Descriptors: *Eutrophication, *Lakes, *Literature review, *Model studies, Bioindicators, Eutrophic lakes, Nutrients, Phosphorus, Phytoplankton, Chlorophyll, Ecosystems, Computer models, Biomass, Laboratories, Algae, Lake restoration, Destratification, Phosphorus removal, Water pollution.

This literature review of 116 publications on eutrophication covers six major aspects of the subject. Two symposia are briefly mentioned: one of 95 papers on nutrient loading relationships, and one of 15 papers on reservoir phytoplankton dynamics. Nutrient loading models based on Vollenweiders approach are still used in management analysis and decision making, and the approach was used for a prediction of total phosphorus developed from data from 704 lakes; statistical phosphorus-reten-

tion models were the subject of another work. Eutrophication indicators were studied in several papers. Specific topics included phytoplankton biomass and its correlation with chlorophyll a and hypolimnetic oxygen consumption in lakes. Complex models of eutrophication and ecosystems with many variables were often used to improve prediction and reduce variance. Validation and uncertainty and parameter estimation in models were important issues in the works reviewed. Nutrient sources and sinks were the subject of studies including storm runoff in urban, wetland, and agricultural areas as well as wastewater effluents. Phosphorus sediment release and cycling and nitrogen fixation were also covered by the works reviewed. Twenty publications covered the topic of biological and chemical interactions. The organisms studied included phytoplankton, zooplankton, diatoms, benthic algae, and water chestnuts. Bioassay and laboratory studies included investigations of algal-available phosphorus and biologically available phosphorus in lakes, of the growth-limiting effect of light on epilimnetic phytoplankton, and of the effect of phosphorus on algal growth. The last category of papers covered the subject of lake management, including analysis methods, lake restoration techniques, phosphorus removal and artificial destratification. (Gish-FRC)
W83-00477

EMERGENCY RESPONSE: A CASE FOR RISK DETERMINATION,
Maine Dept. of Human Service, Augusta.
For primary bibliographic entry see Field 5F.
W83-00494

THE EUTROPHICATION OF CAYUGA LAKE: A HISTORICAL ANALYSIS OF THE PHYTOPLANKTON'S RESPONSE TO PHOSPHATE DETERGENTS,
Massachusetts Univ., Amherst. Water Resources Research Center.
P. J. Godfrey.
Freshwater Biology, Vol 12, No 2, p 149-166, April, 1982. 11 Fig, 4 Tab, 46 Ref. OWRT B-038-NY.

Descriptors: *Lakes, *Eutrophication, *Cayuga Lake, Detergents, Nutrients, Phosphates, Phosphorus, Phytoplankton, Algal growth, Algae, Seasonal variations, Water pollution effects, *New York.

A methodology is presented for comparing past with present data to demonstrate that there has been a significant increase in algal standing crop and a dramatic change in their seasonal succession pattern, and to postulate the causal mechanism for these observations based on the pattern of hydrological inputs of phosphorus and its lake dynamics and the timing of significant changes in the long term pattern of phosphorus loading to Cayuga Lake. Samples were collected weekly between April 1972 and August 1973. The seasonal pattern of total phytoplankton biomass exhibited a maximum in late spring just prior to stratification, a sharp decline to intermediate values that persisted through summer and autumn, a mild resergence at the autumn overturn and yearly minimum from winter through early spring. Coincident with initial summer stratificat ion in July 1972 and 1973, there was a bloom of Anabaena flos-aquae (Lyngb.) DeBrebisson. The combination of data on algal biomass, chlorophyll and Secchi disc transparency serves to describe the long term trend in the lake's trophic state and demonstrate a large increase in algal standing crop in the period roughly coincidental with the advent of phosphorus-based detergents. The increase in algal standing crop from pre-1940 levels to present levels closely corresponds with that predicted by the Oglesby-Schaffner regression model from the increase in phosphorus loading due to phosphorus-based detergents. (Baker-FRC)
W83-00509

THE RESORPTION OF ZINC FROM SCALES OF SEA TROUT (SALMO TRUTTA) DURING THE UPSTREAM SPAWNING MIGRATION,
Liverpool Univ. (England). Dept. of Zoology.
For primary bibliographic entry see Field 5B.
W83-00511

NUTRIENT DEPENDENCE OF PHYTOPLANKTON PRODUCTION IN BROWN-WATER LAKES WITH SPECIAL REFERENCE TO LAKE PAIJANNE,
Hydrobiolofical Research Inst., Jyvaskyla Univ. (Finland).
K. Granberg, and H. Harjula.
Hydrobiologia, Vol 86, No 1/2, p 129-132, January, 1982. 1 Fig, 1 Tab, 16 Ref.

Descriptors: *Nutrients, *Phytoplankton, *Productivity, *Phosphorus, Limiting nutrients, Brown-water, Lakes, Lake Paijanne, *Finland, *Chlorophyll a, Humic acids, Model studies, Water pollution effects.

A model was developed to predict the mean seasonal chlorophyll a concentration, the mean seasonal in vitro phytoplankton primary productivity per unit volume, the maximum daily production per unit volume, and the seasonal integral production in brown-water lakes limited by phosphorus. The values necessary for calculation are mean annual concentration of total P and mean annual color of the water. Data collected at 4 sampling sites of Lake Paijanne, Finland, and in 1972-79 were used to verify the equations. Calculated and predicted results were in reasonable agreement. Differences were mainly due to hydrological and climatic conditions that could not be included. However, the model is adequate for cheap and rapid predictions of the major biological consequences of changes in effluent loads. (Cassar-FRC)
W83-00524

AN OXYGEN MODEL FOR LAKE HAUKIVESI,
National Board of Waters, Helsinki (Finland).
T. Frisk.
Hydrobiologia, Vol 86, No 1/2, p 133-139, January, 1982. 2 Fig, 12 Ref.

Descriptors: *Lakes, *Water quality, *Dissolved oxygen, Hypolimnion, Model studies, Lake Haukivesi, *Finland, Pulp and paper industry, Oxygen, Decomposition, Water pollution effects, Biological oxygen demand, Phosphorus, Phytoplankton, Oxygen demand, Organic matter.

A water quality model to predict dissolved oxygen in the hypolimnion of Lake Haukivesi, Finland, heavily loaded with pulp and paper mill effluents, was developed. The lake was divided into 7 subbasins of 2 layers each, epilimnion and hypolimnion. Transfer between sub-basins was calculated using water balance equations. A hydrological steady state was assumed. State variables were dissolved oxygen, BOD, total P, and phytoplankton biomass; temperature was an external variable. Processes affecting the concentration of dissolved oxygen were BOD decay, reaeration, growth and respiration of phytoplankton, benthic oxygen demand, and oxygen consumption of slowly decaying substances. Preliminary testing of the model indicated that the basic structure was adequate for practical predictions of water quality. However, further development and testing is proceeding, with special attention to mass balance of organic matter and P in sediments. (Cassar-FRC)
W83-00525

WINTER MICROBIAL ACTIVITY IN LAKE TUUSULANJARVI,
Helsinki Water District (Finland).
For primary bibliographic entry see Field 5G.
W83-00528

THE EFFECT OF LAND USE ON THE DIATOM COMMUNITIES IN LAKES,
Joensuu Univ. (Finland). Karelian Inst.
J. Merilainen, P. Huttunen, and K. Pirttiala.
Hydrobiologia, Vol 86, No 1/2, p 99-103, January, 1982. 3 Fig, 11 Ref.

Descriptors: *Diatoms, *Land use, *Species composition, Lakes, Sediments, *Finland, Agricultural watersheds, Peat, Water quality, Chlorides, Oligotrophic lakes, Hydrogen ion concentration, Phosphorus.

The relationship of diatom community structure to land use was investigated using data from 151 oligotrophic lakes in eastern Finland. Lakes ranged from 5 to 1500 ha and did not included those with short residence time or shallow unstratified lakes. Lakes in catchments with little or no arable fields had pH of 4.5-7.5. Lakes in agricultural watersheds had pH of 6.5 or greater. Field percentage was positively correlated with conductivity, Na, K, Ca, and Mg concentrations of lake water and highly significantly correlated with Cl. An increasing percentage of peatland was correlated with a decrease in pH. Lakes surrounded by fields rarely contained Melosira distans (s.s.), Frustulia rhomboides (including F. R. var. saxonica), and Eunotia spp. (excluding E. arcus), common diatoms in oligotrophic lakes. However, Fragilaria construens (s.l.) was well represented in lakes in agricultural areas. Increasing pH decreased the proportion of Frustulia rhomboides and Eunotia spp. Fragilaria construens and Melosira ambigua were more frequent in waters with higher pH. Increasing conductivity of water was correlated with decreases in proportions of Frustulia rhomboides, Eunotia spp., and Melosira distans, whereas Fragilaria construens and Melosira ambigua increased. Frustulia rhomboides, Eunotia spp., and Melosira distans decreased with increasing total phosphorus levels. (Cassar-FRC)
W83-00530

THE INFLUENCE OF SULPHITE MILL EFFLUENTS ON HETEROTROPHIC ACTIVITY AS MEASURED BY GLUCOSE ASSIMILATION,
Tvarminne Zoological Station (Finland).
J. Kuparinen.
Hydrobiologia, Vol 86, No 1/2, p 115-119, January, 1982. 4 Fig, 11 Ref.

Descriptors: *Heterotrophic bacteria, *Sulfite liquors, *Phytoplankton, *Adaptation, Water pollution effects, Pulp wastes, Primary productivity, Productivity, *Finland.

The effect of sulfite mill effluents on the heterotrophic activity of natural populations in Finland receiving waters was studied during the summer of 1979. Effluent was added at concentrations of 0.001-10% to water samples from different sections of rivers receiving effluent. Organisms near the discharge point were adapted to high concentrations of the effluent (up to 10%). At other stations 50% inhibition was seen as low as 0.01%. Low concentrations of effluent, 0.001-0.1%, stimulated heterotrophic activity at some stations. Primary productivity was 10-100 mg C per cu m per day, lowest at the sites highest in effluent concentrations. Turnover times were 5-20 hours. (Cassar-FRC)
W83-00536

SPECIES ASSOCIATIONS AND METAL CONTENTS OF ALGAE FROM RIVERS POLLUTED BY HEAVY METALS,
Cambridge Univ. (England). Dept. of Applied Biology.
P. L. Foster.
Freshwater Biology, Vol 12, No 1, p 17-39, February, 1982. 8 Fig, 5 Tab, 61 Ref.

Descriptors: *Algal growth, *Trace metals, Metals, Lead, Zinc, Rivers, Water pollution effects, Iron, Copper, Mining wastes, River Hayle, River Gannel, *England, Industrial wastes, Drainage.

The algal flora of several siteson the Rivers Hayle and Gannel were examined and an evaluation was made on the impact of heavy metal pollution on the abundance, diversity, and species composition of the algal communities. The metal composition of the dominant filamentous algae is also presented and related to ambient concentrations. The River Hayle is located in a former copper and tin mining area. The River Gannel drains the Cornish lead mining region of Newlyn Downs. Both the total algal abundance and the number of species were depressed at sites of high metal concentrations. Associations of species that were evident in field samples were confirmed and correlated with water

metal levels by principal component analysis. The degree of metal pollution, rather than the polluting metal per se, determined the species present. All mine sites were characterized by a Microspora community, whereas a Zygnemales community of Spirogyra and Mougeotia species was typical of low metal pollution. Moderately polluted sites downstream of the mines had an intermediate flora of Zygnemales, Microsporales, Ulotrichales and gelatinous Volvocales and Tetrasporales species. No species could be used to invariably indicate metal pollution. For copper and iron both algal metal contents and concentration ratios were positive functions of water metal levels, although algal iron appeared to plateau at water concentrations of about 1 mg/ml. Algal lead concentrations, but not concentration ratios, were also positively correlated with water lead levels. (Baker-FRC)
W83-00537

METAL RESISTANCES OF CHLOROPHYTA FROM RIVERS POLLUTED BY HEAVY METALS,
Cambridge Univ. (England). Dept. of Applied Biology.
P. L. Foster.
Freshwater Biology, Vol 12, No 1, p 41-61, February, 1982. 2 Fig, 6 Tab, 38 Ref.

Descriptors: *Rivers, *Heavy metals, *Algae, Population dynamics, Zinc, Cadmium, Metals, Water pollution effects, Chlamydomonas, Gloeococcus, *Chlorophyta, *England.

The metal sensitivities of a large number of isolates from two Cornish rivers were experimentally determined, and the distributions of metal resistance within these algal associations were evaluated. The two rivers were polluted, one with lead and the other with copper. By comparing significant portions of the algal communites from variously contaminated sites, the degree to which the metals were selecting tolerant races or naturally resistant species could be assessed. Two hundred isolates comprising 87 species of Chlorophyta were obtained. In general, all were resistant to the metals normally present in their own habitats. However, the distribution of metal sensitivities of the algae from a given site was broad. The effect of metal pollution was to shift the median response of a population toward higher metal resistance. Resistant algae of two general classes were identified. Some normally sensitive species were metal tolerant, presumably through genetic adaptation. Other species were metal resistant even when isolated from a non-polluted habitat. Many isolates of both types displayed multiple resistances or co-tolerances. For example, copper tolerant isolates from high copper sites tended to be also lead resistant. However, algae from high lead sites were very copper sensitive. Zinc and cadmium resistances also were correlated among isolates from both zinc-polluted and non-polluted sites. General metal-insensitivity seemed to be common, particularly among gelatinous Chlamydomonas and Gloeococcus species. Thus several evolutionary strategies appear to coexist among algae from metal polluted environments. (Baker-FRC)
W83-00538

SOME EFFECTS OF ORGANIC POLLUTION ON THE DISTRIBUTION AND SEASONAL INCIDENCE OF CHIRONOMIDAE IN RIFFLES IN THE RIVER COLE,
Aston Univ., Birmingham (England). Dept. of Biological Sciences.
L. J. Davies, and H. A. Hawkes.
Freshwater Biology, Vol 11, No 6, p 549-559, December, 1981. 5 Fig, 3 Tab, 25 Ref.

Descriptors: *Water pollution effects, *Midges, Wastewater disposal, Seasonal variations, Rivers, River Cole, Organic compounds, *England.

The distribution and seasonal abundance of chironomid larvae in a stream receiving sewage effluent was investigated. Sampling was carried out on the River Cole, a tributary of the River Blythe. The stream arises to the southwest of Birmingham and flows northwards through a rural and then residential area before entering a highly industrialized zone of the city. An intensive monthly sampling program was undertaken between December 1966 and December 1967. The river water can be described as moderately hard and slightly alkaline. Usually the calcium concentration and pH increased downstream, although the differences between the stations were not great. The sewage effluent reduced the dissolved oxygen concentration and increased the ammonia, orthophosphate and biochemical oxygen demand concentrations in the water. The effects were much more severe during the summer. The Chironomidae were very important constituents of the benthic macroinvertebrate community at the stations downstream of the effluent. Larval densities of over 30,000/square meter were noted. Eleven species were common, and of these, Chironomus riparius was the most tolerant. There was considerable variation in the seasonal incidence of the different species. Brillia longifurca was the most abundant in spring, while Cricotopus bicinctus was most abundant in the summer. Brillia longifurca, Paratrichocladius rufiventris, Prodiamesa olivacea, Micropsectra atrofasciata and Eukiefferiella claripennis had three peaks in numbers of larvae during the year. (Baker-FRC)
W83-00539

EFFECTS OF CHLORINATED SEWAGE EFFLUENTS ON FISH IN THE SHEEP RIVER, ALBERTA,
Calgary Univ. (Alberta). Dept. of Biology.
L. L. Osborne, D. R. Iredale, F. J. Wrona, and R. W. Davies.
Transactions of the American Fisheries Society, Vol 110, No 4, p 536-540, July, 1981. 2 Tab, 28 Ref.

Descriptors: *Water pollution effects, *Fish populations, *Chlorination, Fish, Wastewater disposal, Wastewater treatment, Dissolved oxygen, Biochemical oxygen demand, Toxicity, *Alberta.

The effects of chlorinated municipal wastes on fish in the Sheep River, Alberta, Canada were investigated. The 24-hour acute toxicity of unchlorinated and chlorinated municipal wastes to caged rainbow trout in the field, the avoidance by fish of chlorinated sewage effluents in the field, and the effects on fish of restricting the chlorinated effluent to only one side of the river were studied. The absence of mortality to fish during the unchlorinated bioassay demonstrated that the Turner Valley municipal sewage effluent was not acutely toxic to caged rainbow trout during a 24 hour exposure. The depletion of fish populations downstream of chlorinated domestic discharges has been attributed to a reduction in dissolved oxygen rather than to effluent toxicity. However, the dissolved oxygen concentration in the study area was consistently high, and the cause of mortality in stations further downstream was related to chlorination of the effluent as the principal factor. While fish did usually avoid the chlorinated effluents, they moved into and out of the chlorinated effluent, presumably to forage. (Baker-FRC)
W83-00582

SURVIVAL AND GROWTH OF PHYTOPHAGOUS FISH AS A FUNCTION OF OXYGEN CONCENTRATION IN WATER,
Akademiya Nauk URSR, Kiev. Inst. Hidrobiologii.
V. R. Alekseyenko.
Hydrobiological Journal, Vol 17, No 3, p 107-108, 1981.

Descriptors: *Fish, *Oxygen depletion, *Growth rates, Water pollution effects, *Dissolved oxygen, Adaptation, Larvae, Fish eggs, Grass carp, White bighead, Oxygen, USSR.

The growth and survival of phytophagous fish larvae were studied at varying concentrations of dissolved oxygen. In the first series of experiments grass carp and white bighead larvae, 3-4 days old, hatched from high quality eggs were subjected to dissolved oxygen concentrations of 1 to 10 mg per liter at 30C for 12-15 days. No significant correlation was found between larval survival and oxygen concentration. However, the growth rate of grass carp larvae was 12-16% lower at 1.7-2.3 mg per liter dissolved oxygen (final length 17.7-18.4 mm) than at 3.7-8.3 mg per liter (final length 20-22 mm). The second series of experiments used larvae from eggs of low viability. Survival of these larvae was significantly lower at lower oxygen concentrations. Grass carp larval survival was 46-51% in water with high oxygen content and 20-24% in water with low oxygen content. White bighead larvae survival was 39-54% in water with high oxygen content and 25-30% in water with low oxygen content. (Cassar-FRC)
W83-00594

THE STRUCTURE AND ABUNDANCE OF RYBINSK RESERVOIR ZOOPLANKTON AS A FUNCTION OF THE CONCENTRATION OF ZINC AND CHROMIUM COMPOUNDS,
Moscow Univ. (USSR).
N. V. Kartasheva, and L. I. Lebedeva.
Hydrobiological Journal, Vol 17, No 2, p 60-65, 1981. 3 Tab, 14 Ref.

Descriptors: Metals, *Toxicity, *Zooplankton, Water pollution effects, Heavy metals, Reservoirs, *Zinc, *Chromium, Rybinsk Reservoir, Rotatoria, Copepods, Invertebrates, Species composition, Sublethal effects, Laboratory studies, *USSR.

Natural zooplankton communities from Rybinsk Reservoir were subjected to 9 combinations of Zn and Cr dissolved in water in laboratory tanks. Metals levels (in mg per liter) were: 0.115 of Zn and 0.002 of Cr, the natural levels in water; 1 of Zn and 0.1 of Cr, the maximum permissible concentrations; and 2 of Zn and 1 of Cr, multiples of the maximum permissible concentrations. Community changes were observed during 3 periods during which: (1) the control population did not differ from the natural reservoir population, about 7 days long; (2) the population in the control and dosed tanks changed with respect to the natural reservoir populations; and (3) a specific community structure was established as a response to the toxic substances providing that the entire community was not destroyed. Zn was more toxic than Cr. Rotatoria abundance was reduced 8-12 times by 1 mg per liter Zn and 3-4 times by 1 mg per liter Cr. As Rotatoria declined, Copepoda increased in abundance. The effect of the 2 metals was additive. At the maximum concentrations of both metals in combination, the zooplankton population had completely degraded within a month. Rotatoria were more sensitive to both metals than other zooplankton. Brachionus angularis and Filinia longiseta were more sensitive to Zn; Polyarthra euryptera and P. luminosa, to Cr. (Cassar-FRC)
W83-00596

THE FEEDING OF KANEV RESERVOIR FISHES IN CONNECTION WITH THE DISCHARGE OF HEATED WATER FROM THE TRIPOL'YE POWER STATION,
Akademiya Nauk URSR, Kiev. Inst. Hidrobiologii.
N. S. Severenchuk.
Hydrobiological Journal, Vol 17, No 2, p 15-17, 1981. 6 Ref.

Descriptors: Fish, *Thermal pollution, *Food habits, Water pollution effects, Heated water, Tripol'ye Power Station, Kanev Reservoir, *USSR, Powerplants, Fish food organisms, Seasonal variation.

The effect of the heated water discharges from the Tripol'ye Power Station on the nutrition of mature fishes in Kanev Reservoir was investigated in 1974-77. Conditions for feeding of bream and blue bream were slightly more favorable in the heated zone than in the unheated zone. For the other fish (white bream, roach, and ide) there was little difference in feeding in the different zones. Main food items for fish in this reservoir were mollusks, gammarids, oligochaetes, and larvae of aquatic insects. Supplementary foods included water plants, algae, and detritus. Blue bream also consumed crustaceans. In spring fish were hungry and consumed all the available food items regardless of type. In summer, with abundant food, a few preferred items were selected. During autumn feeding activity declined, and diversity of food consumed increased

slightly. In winter fish fed appreciably less but still showed preference for some food items. (Cassar-FRC)
W83-00598

FUNDAMENTAL PRINCIPLES OF THE COMPARATIVE TOXICOLOGICAL EXPERIMENT,
Institute of Ecological Toxicology, Baikal (USSR).
V. A. Alekseyev.
Hydrobiological Journal, Vol 17, No 3, p 73-80, 1981. 1 Fig, 2 Tab, 4 Ref.

Descriptors: *Toxicity, Aquatic life, *Indicators, Invertebrates, *Bioindicators, Water pollution effects, Survival, Mortality, *Lethal limit.

A unified system of indicator organisms for testing toxicity of water pollutants is suggested. This procedure is based on the comparative tolerance of aquatic organisms of different taxonmic rank to various toxic substances. A list of taxa suitable for use in the studies is given. It includes crustcea, insects, arachnids, flat and round worms, annelids, leeches, and mollusks. Procedures are described for collecting the faunal specimens, for exposing them to the toxicants, and for recording results. The experiments produce the following indicators: maximum tolerated concentrations (LD100 and LD50) and maximum concentration at which no organism dies (LD0). The animals present in the sample are ranked according to tolerance in terms of the above 3 indicators. (Cassar-FRC)
W83-00603

SEASONAL SUCCESSION OF PHYTOPLANKTON IN AN ICE-FREE POND WARMED BY A THERMAL POWER PLANT,
Jyvaskyla Univ. (Finland). Dept. of Biology.
P. Eloranta.
Hydrobiologia, Vol 86, No 1/2, p 87-91, January, 1982. 2 Fig, 7 Ref.

Descriptors: *Thermal pollution, *Phytoplankton, *Cooling water, Water pollution effects, Zooplankton, Seasonal variation, Periphyton, Heated water, Powerplants, Diatoms, Succession, Nutrients, Water temperature, Primary productivity, Productivity, Ponds, Light penetration, Light intensity.

Water quality, phytoplankton, zooplankton, and periphyton were monitored from January 1979 to September 1980 in a nearly ice free pond which receives thermal discharges from a power plant. The pond is stratified in summer. In winter temperature is nearly even from surface to bottom, and circulation occurs in the 0-4 m layer. No sewage enters this moderately eutrophic pond. Primary production was low (2 mg C assimilated per sq m per day) and phytoplankton biomass was almost zero in January-February during low light conditions. Rapid growth of phytoplankton (cryptomonads and diatoms) started in mid-February as light intensity, nutrient conditions, and herbivorous zooplankton also increased. In mid-March phytoplankton biomass reached a peak of 10 g per cu m and rapidly declined due to lack of free phosphorus and silica. From May to August phytoplankton biomass and primary production fluctuated as a result of zooplankton ingestion. Productivity declined from August to winter, but phytoplankton (large-celled Cyclotella meneghiniana) reached a peak of 10 g per cu m in September. At this time zooplankton concentrations were low and nutrient concentrations had increased. Periphyton growth reached peaks of about 0.7 micrograms chlorophyll a per sq cm per 2 weeks in March and September. (Cassar-FRC)
W83-00605

COMMUNITY HEALTH ASSOCIATED WITH ARSENIC IN DRINKING WATER IN MILLARD COUNTY, UTAH,
Utah Dept. of Health, Salt Lake City.
J. W. Southwick, A. E. Western, M. M. Beck, J. Whitley, and R. Isaacs.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-108374, Price codes: A04 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S1-81-604, February 1982, 3 p, 2 Tab.

Descriptors: *Arsenic, *Drinking water, *Toxicity, *Carcinogens, *Water pollution effects, Human pathology, Population exposure, Water quality standards.

This study evaluates the human health effects of ingesting drinking waters with arsenic at levels about four times the United States Environmental Protection Agency primary drinking water standard. Examinations of 250 cases included dermatological, neurological, and anemia endpoints. Hair and urine were tested for arsenic content. Estimates of water consumption provided the exposure criteria. One hundred and forty-five 'exposed' cases drank water with arsenic at 0.18 - 0.21 mg/liter. One hundred and five matched controls were selected from a neighboring community with arsenic at 0.02 mg/liter in their drinking waters. Cases were of either sex, over five years old, and residents of the community for the last five years. Controls were selected by random number selection from within age categories to match age and sex distribution of the exposed population. No exposure of controls to arsenic by use of arsenic-containing chemicals was found. A clear relationship is shown between amount of arsenic consumed and levels in urine and hair. Dermatological signs associated with arsenic exposure were rare and scattered among exposed and control participants. Anemia, nerve conduction slowing, and signs/symptoms of arsenic intoxication were not found in the study population. Cancer incidence or mortality did not show an excess in the exposed community. No adverse human health effects were discovered among this relatively small population exposed to drinking water with arsenic at four times the primary drinking water standard. (Author's abstract)
W83-00630

INVESTIGATION ON THE MICROBIOLOGY OF THE SAAR RIVER (UNTERSUCHUNG ZUR MICROBIOLOGIE DER SAAR),
Universitaet des Saarlandes, Saarbruecken (Germany, F.R.). Dept. of Microbiology.
For primary bibliographic entry see Field 5B.
W83-00649

MICROBIOLOGY: DETECTION OF BACTERIAL PATHOGENS AND THEIR OCCURRENCE,
Environmental Protection Agency, Cincinnati, OH. Drinking Water Research Div.
For primary bibliographic entry see Field 5A.
W83-00658

LAKE ERIE CLADOPHORA IN PERSPECTIVE,
Ecology and Environment, Inc., Buffalo, NY.
For primary bibliographic entry see Field 2H.
W83-00661

ECOLOGICAL STUDIES AND MATHEMATICAL MODELING OF CLADOPHORA IN LAKE HURON: 3. THE DEPENDENCE OF GROWTH RATES ON INTERNAL PHOSPHORUS POOL SIZE,
Michigan Technological Univ., Houghton. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2H.
W83-00662

MANAGING WATER QUALITY IN CHANNEL CATFISH PONDS,
Auburn Univ., AL. Dept. of Fisheries and Allied Aquacultures.
For primary bibliographic entry see Field 5G.
W83-00666

INFLUENCE OF TEMPERATURE AND RIVER DISCHARGE ON WATER QUALITY OF THE WESTERN SCHELDT ESTUARY,
Brussels Univ. (Belgium). Lab. of Oceanography.
M. Somville, and N. De Pauw.
Water Research, Vol 16, No 8, p 1349-1356, August, 1982. 13 Fig, 1 Tab, 13 Ref.

Descriptors: *Water quality, *Estuarine environment, *Temperature effects, Physical properties, River flow, Streams, Scheldt Estuary, Dissolved oxygen, Nitrates, Nitrification, Oxygen, Ammonium, *Belgium, Western Scheldt estuary.

The evolution of the oxygen, nitrate and ammonium concentrations over a 15 year period were studied in relation to variations of hydrodynamical (river discharge) and environmental (temperature) parameters in the self-purifying part of the Western Scheldt estuary. In the polluted part of the stream, ammonium concentrations over the period 1967-1977 have also been considered. Oxygen, ammonium concentrations, and the start of the nitrification process were found to be yearly cyclic parameters, indicating the strong relationship between water quality and environmental parameters. After eliminating the effect of environmental parameters on water quality, it was demonstrated that neither the ammonium concentration in the polluted part of the Scheldt estuary, nor the self-purification parameters, dissolved oxygen and nitrification, in the recuperating part of the stream, have changed significantly during the study periods of 1967-77, 1964-79, and 1973-77, respectively. It was concluded that, in order to assess improvement or deterioration of the water quality in an estuary, all parameters related to the self-purification process (oxygen, nitrate) or organic load breakdown (ammonium) must be considered at the same time as the hydrodynamical parameters, such as river discharge and temperature. (Baker-FRC)
W83-00669

THE RESPONSE OF A PERCH, PERCA FLUVIATILIS L., POPULATION TO EUTROPHICATION AND ASSOCIATED CHANGES IN FISH FAUNA IN A SMALL LAKE,
Reading Univ. (England).
P. R. Bregazzi, and C. R. Kennedy.
Journal of Fish Biology, Vol 20, No 1, p 21-31, January, 1982. 3 Fig, 2 Tab, 41 Ref.

Descriptors: *Fish populations, *Eutrophication, Lakes, Slapton Ley, Fish management , Growth, Aquatic life, *Perch, Fisheries, Natural waters, *United Kingdom.

Dynamic changes in the fish population of Slapton Ley were investigated. Various parameters associated with the perch population were studied in depth as this environment was subjected to increasing eutrophication. The study revealed no adaptive responses to the increasing eutrophication had taken place. The growth rate of perch up to the age of III had only slightly declined and there was a marked preponderance of young fish. Relative growth rate was consistent in spite of the population decline. No dominant year class was apparent. Mean instantaneous mortality rate and annual survival rate were calculated, and the length-weight relationship was analyzed. Feeding strategy had not altered since an earlier study in the 1970s. A decline was noted in the percentage of perch maturing at early age. Ripeness coefficients and fecundity estimates were calculated. A previously documented spawning migration was confirmed. The findings of this study are atypical for a declining perch population, changes observed not being adaptive and not conforming to theoretical prediction or practical expectation. While the reasons for this singularity of experience at Slapton are not known, their implications for proper management of fish and natural waters are considerable. (Baker-FRC)
W83-00678

5D. Waste Treatment Processes

RAPID INFILTRATION TREATMENT OF PRIMARY AND SECONDARY EFFLUENTS,
Camp Dresser and McKee Inc., Denver, CO.
R. R. Carlson, K. D. Linstedt, E. R. Bennett, and R. B. Hartman.
Journal of the Water Pollution Control Federation, Vol 54, No 3, p 270-280, March, 1982. 13 Fig, 3 Tab, 8 Ref.

Descriptors: *Land disposal, *Wastewater treatment, Infiltration, Secondary wastewater, Nitro-

gen removal, Phosphorus removal, Water reuse, Water quality, Coliforms, Chemical oxygen demand, *Colorado, Boulder.

Primary and secondary effluents were applied to a rapid infiltration system during different project phases in an effort to assess the relative capabilities of the system for providing either tertiary treatment or a combined secondary and tertiary treatment in a single treatment stage. The trickling filter plant used in the study is located in Boulder, Colorado. The soil at the site is of the Niwot Series, consisting of loam, sandy loam, or clay loam to a depth of 1 to 3 feet, below which coarse gravel and sand extend to the bedrock formation, which is found at a depth of 8 to 10 feet. The three basins were loaded at a rate of 100, 42, and 160 feet per year of secondary effluent and at a rate of 50, 144, and 120 feet per year of primary effluents, respectively, during separate phases of the tests. The rapid infiltration system was shown to be capable of providing a high quality renovated water with minimum pretreatment prior to application to the rapid infiltration basins. The infiltration rates on the rapid infiltration basins were higher when primary effluent was applied to the system than when secondary effluent was applied. No operational or aesthetic difficulties related to the application of primary effluent to the rapid infiltration basins occurred during a 1-year test period. The chemical oxygen demand of the renovated water was essentially the same for both primary and secondary effluent applications. A consistently low level of phosphorus in the renovated water was achieved when the rate of phosphorus application to the rapid infiltration system was consistent with the rate of the long-term removal mechanisms. Virtually all of the nitrogen applied to the three basins was oxidized by nitrification and discharged as nitrate nitrogen in the renovated water, resulting in occasional excesses of nitrate levels in the renovated water. Although the basins provided major reductions in fecal coliform concentrations, disinfection would be required prior to discharge of the renovated water to a surface water system. (Carroll-FRC)
W83-00358

VELOCITY-DEPENDENT REACTION RATES IN A SLIME REACTOR,
Engineering-Science Inc., Austin, TX.
F. J. Castaldi, and J. F. Malina, Jr.
Journal of the Water Pollution Control Federation, Vol 54, No 3, p 261-269, March, 1982. 8 Fig, 35 Ref.

Descriptors: *Biological wastewater treatment, *Slime, Microbial degradation, Biomass, Kinetics, *Wastewater treatment, *Reynolds Number.

The nature of the diffusion kinetic phenomenon in a microbial slime reactor was investigated, with emphasis on the equilibrium reactor rate observed in laboratory scale slime reactors. Convective diffusion with reaction in microbial slime reactors was studied over Reynolds Numbers ranging from laminar to turbulent flow, in both a random and a continuous manner. The data indicated that the observed reaction rate in a microbial slime reactor is a function of velocity intensity and the substrate concentration in the bulk stream and that the turbulence level in the reactor is the parameter of greatest concern. An apparent abrupt change in the physical properties of the system occurs at a critical magnitude of the Reynolds Number. Below the observed limiting oxygen concentration, the apparent uptake rate was found to be primarily a surface reaction, regardless of the magnitude of the velocity intensity. As a result, solids retention time and quantity of biomass are not a primary concern when a microbial slime reactor is operating under laminar flow conditions. (Carroll-FRC)
W83-00359

CONTROL OF ALGAL FILAMENTOUS BULKING AT THE SOUTHERLY WASTEWATER TREATMENT PLANT,
Delaware Univ., Newark. Dept. of Civil Engineering.
A. F. Rozich, R. M. Sykes, G. B. Walkenshaw, and D. R. Rodgers.
Journal of the Water Pollution Control Federation, Vol 54, No 3, p 231-237, March, 1982. 2 Fig, 7 Tab, 16 Ref.

Descriptors: *Algal control, *Sludge bulking, *Wastewater treatment, Activated sludge, Cyanophyta, Algae, Aeration, Fatty acids, Industrial wastewater, Dissolved oxygen, *Ohio, Columbus.

The Southerly Wastewater Treatment Plant in Columbus, Ohio, has experienced algal filamentous bulking of its activated sludge during the late summer and early fall of each year since 1971. The cyanobacterium Schizothrix calcicola is responsible for this bulking. Laboratory studies have shown that S. calcicola is kinetically limited by acetate, proliferating only in plug-flow reactors having limited but not anoxic inlet-end dissolved oxygen concentrations, and that high volatile fatty acid concentrations were needed in the influent water for bulking to occur. A full-plant scale demonstration was designed to investigate whether the bulking could be controlled by eliminating one or both of the two causes. Conversion of Southerly's mixed liquor aeration tanks from strict plug flow to distributed load configurations did not result in control of bulking. Installation of additional diffusers in the aeration tanks permitted maintenance of an averaged dissolved oxygen of 0.8 milligrams per liter at the tank inlets, even under strict plug flow conditions. This approach was more effective in controlling bulking than load distribution plus chlorination of the return sludge. When increased aeration was accompanied by a reduction in the influent volatile fatty acids, which was achieved by restricting the flow of brewery wastes into the plant, filamentous bulking caused by S. calcicola was effectively controlled. These studies showed that laboratory and pilot plant studies can successfully predict the conditions leading to bulking in full-scale plants if all the important variables affecting the microbes are considered. (Carroll-FRC)
W83-00369

FATE OF VIRUS IN WASTEWATER APPLIED TO SLOW-INFILTRATION LAND TREATMENT SYSTEMS,
Army Medical Bioengineering Research and Development Lab., Fort Detrick, MD.
For primary bibliographic entry see Field 5B.
W83-00386

THE THEORY AND DESIGN OF AEROBIC BIOLOGICAL TREATMENT,
Akademiya Nauk SSSR, Moscow. Inst. Vodnykh Problem.
V. A. Vavilin.
Biotechnology and Bioengineering, Vol 24, No 8, p 1721-1747, August, 1982. 15 Fig, 1 Tab, 25 Ref.

Descriptors: *Biological treatment, *Design criteria, *Aerobic treatment, Model studies, Kinetics, Biomass, Aeration, Trickling filters, Rotating disks, *Wastewater treatment.

Analysis of experimental data shows that high-level and rough treatment of sewage water are described by different equations. The classical Monod model is adequate for rough treatment. High concentrations of a pollutant saturate the biomass, and the general oxidation process follows a zero-order for the substrate. For high-level treatment, the model of an n-order ($n > 1$) for the substrate is usable. General models for aerobic treatment, proposed in this paper, are independent of reactor type (aeration tank, trickling filter, or rotating disk). The models use only 3 coefficients: pmax, the maximal specific rate of the treatment process; ks, the half-saturation constant, and n. (Cassar-FRC)
W83-00413

URBAN RUNOFF CONTROL TECHNOLOGY,
Ontario Ministry of the Environment, Toronto.
G. Zukovs, D. G. Weatherbe, and J. Marsalek.
Civil Engineering (New York), Vol 52, No 8, p 50-52, August, 1982. 3 Fig, 1 Tab.

Descriptors: *Urban runoff, *Storm water, *Flow control, Runoff, Controlled drainage, Wastewater treatment, Inlets, Underground storage, Water storage, Storm sewers, *Ontario, Controlled storage, Storage, Bacteria, Drainage, Ponds, Storm runoff, Storm wastewater, Coliforms.

A variety of controls for urban runoff quantity and quality has been used in the Ontario region. These include inlet controls to restrict flow to sewers during high, intense precipitation or to permit overland drainage where feasible and underground storage or pond storage in parks and other locations. Studies on storm water treatment of pollutants revealed that 10 hours of quiescent settling or alum flocculation with 2 hours quiescent settling were effective in removing pollutants. Bacterial levels were not significantly reduced by natural settling, but dosage of 5 mg per liter available Cl reduced fecal coliforms to less than 10 per 100 ml. (Cassar-FRC).
W83-00416

NEW EVAPORATION PROCESS: KEY TO ZERO DISCHARGE FOR ELECTROPLATERS.
Civil Engineering (New York), Vol 52, No 8, p 58-59, August, 1982. 2 Fig.

Descriptors: *Vapor compression distillation, *Chromium, *Electroplating, *Wastewater treatment, Zero discharge, Metal-finishing wastes, Industrial wastewater, Water reuse, Evaporation.

A vapor-recompression evaporation process was installed at the Navy's Pensacola Rework facility in 1981 to provide zero discharge treatment for chromium electroplating wastes. In this closed system the chromic acid laden rinse water is evaporated to a concentration equal to that of the original plating bath and is recycled. Evaporated water is condensed for reuse as rinse water. No chemical addition is necessary, and no sludge is generated. The process requires only 1/12 the energy of normal evaporation processes. Capital investments for vapor-recompression evaporation are slightly higher than the precipitation-clarification process, but evaporation operating costs are 15% lower. (Cassar-FRC)
W83-00417

LIME IN WASTEWATER TREATMENT,
British Quarrying and Slag Federation Ltd., Croydon (England).
A. S. Anthony.
Effluent and Water Treatment Journal, Vol 22, No 6, p 244, June, 1982. 3 Ref.

Descriptors: *Wastewater treatment, *Lime, Sludge conditioning, Chemical reactions, United Kingdom, Water pollution control, Industrial wastes, Bacteria, Phosphates, Organic matter.

The use of lime in the removal of impurities from wastewater, including sewage and industrial effluent is briefly noted. In many areas of the United Kingdom, water is reused several times before making its way to the sea. Treatment works employ mechanical, biological, and chemical processing to produce, at the lowest possible cost, a discharge of the required standards and byproducts which can be handled and disposed of without causing nuisance to the general public. Chemicals are added to sewage effluent to modify the ionic state of the dispersed phase so that agglomeration is encouraged and settling or filtration techniques can be used efficiently to effect separation and to combine chemically with active materials to reduce the pollution potential. Combinations of lime with other chemicals are often used to enhance performance. Lime has been used in the United Kingdom for the treatment of sewage and industrial wastes for more than 100 years. It is available as quicklime (calcium oxide) or hydrated lime (calcium hydroxide). The major use of lime in sewage treatment is in the conditioning of sludge prior to mechanical dewatering. Substantial quantities of lime are also used in the chemical treatment of industrial effluent at source to remove toxic compounds and heavy metals and to adjust the pH of the effluent to a level suitable for sewage treatment processes or discharge into water courses or rivers. Lime also ensures that the biological process is not overloaded or reduced in efficiency by

toxic materials. Lime serves as a coagulant in primary sedimentation to improve throughput rates and to assit in the removal of greases and fats which can cause trouble later. Lime used to treat raw sewage rather than secondary effluent not only removes phosphates but also enables removal or a large portion of organic material present in suspension. (Baker-FRC)
W83-00427

FATE AND DISTRIBUTION OF A QUATERNARY AMMONIUM SURFACTANT, OCTADECYLTRIMETHYLAMMONIUM CHLORIDE (OTAC), IN WASTEWATER TREATMENT,
Procter and Gamble Co., Cincinnati, OH. Packaged Soap and Detergent Div.
L. M. Games, J. E. King, and R. J. Larson.
Environmental Science and Technology, Vol 16, No 8, p 483-488, August, 1982. 4 Fig, 4 Tab, 16 Ref.

Descriptors: *Surfactants, *Biodegration, *Activated sludge process, Fate of pollutants, *Wastewater treatment, Detergents, Degradation, Linear alkyl sulfonates, Mineralization, *Quaternary ammonium compounds, Octadecyltrimethylammonium chloride.

The distribution and transformation of alkyl and methyl C14-labeled octadecyltrimethylammonium chloride (OTAC), a quaternary ammonium surfactant, were studied in a laboratory scale activated sludge system. OTAC was adsorbed to the wastewater solids and biodegraded rapidly at initial concentrations of 0.1 to 20 mg per liter. More than 99% of the OTAC was adsorbed within 30 min of addition; biodegradation was slower and followed first-order kinetics. A mixture of 20 mg per liter each of OTAC and linear alkylbenzene sulfonate followed first-order kinetics after a 2-3 day lag period. The half life for OTAC primary biodegradation kinetics, based on the first-order biodegradation rate constant, was 2.5 hours. Mineralization of the methyl and alkyl carbons was slower, with half lives of 28 and 40 hours, respectively. (Cassar-FRC)
W83-00433

SOME OPTIONS FOR TREATING LIQUID WASTES FROM NITROGEN FERTILIZER FACTORIES,
L. D. Roland.
Effluent and Water Treatment Journal, Vol 22, No 6, p 216-220, June, 1982. 3 Fig, 3 Tab, 7 Ref.

Descriptors: *Wastewater treatment, *Nitrogen compounds, *Fertilizers, Agricultural chemicals, Urea, Industrial wastes, Ammonium nitrate, Nitrates, Absorption, Reverse osmosis, Chemical reactions, Evaporation, Precipitation, Steam stripping, Distillation, Shock loads.

With nitrogen fertilizer waste there exists the possibility of recovery and return of part of the effluent for reuse. During the manufacture of the two major nitrogen fertilizers, urea and ammonium nitrate, water is a product of each reaction and is removed in later stages by evaporation, giving rise to a distillate contaminated with fertilizer. In many older plants nitrogen bearing wastewater also arises from leakages and washdowns. Dust emissions can also be contaminated leading to rainwater run-off problems. Treatment of urea wastes may include a biological one which is a nitrification step followed by denitrification, both steps including activated sludge recycling and clarification. Other methods include absorption, treatment with nitric oxide, hydrolyzer stripper or evaporative scrubber. Ammonium nitrate wastes present more difficult pollution problems. Ion exchange was viewed as the best approach, with the choice being between a fixed bed and a continuous system. Alternative treatments included reverse osmosis, steam stripping, precipitation, distillation, evaporative scrubber, and biological treatment. Difficulties with shock loads, required start up time, and the temperature dependance of bacteria activity are discussed. (Baker-FRC)
W83-00440

POLLUTION FROM US EXPLOSIVES AND PROPELLANTS PRODUCTION,
L. K. Wang, M. H. Wang, V. J. Ciccone, and R. G. Ross.
Effluent and Water Treatment Journal, Vol 22, No 6, p 222-223, 225, June, 1982. 2 Tab, 18 Ref.

Descriptors: *Explosives, *Propellants, *Industrial wastes, Phossy water, TNT, Phosphorus, *Nitrocellulose, Nitroglycerin, Hazardous materials, Munitions, *Wastewater treatment.

Nitrocellulose is a principal ingredient of all propellants, and is made by treating cotton linters or wood pulp cellulose with mixed nitric and sulfuric acids. Following the reaction, the processed material is wrung, then 'drowned' in water for the removal or most of the acids. The crude product is subjected to a 70 hr prolonged boiling with dilute sulfuric acid and subjected to several purification steps. A large amount of process water is needed, most of which is discharged as wastewater containing nitrocellulose fine particles and considerable amounts of sulfuric and nitric acids. While only a minimal toxicological hazard has been associated with nitrocellulose fines in water, since it does occur as a colloid and is not amenable to biodegradation, physicochemical pretreatment of such wastewaters is considered necessary prior to any biological treatment system. In the production of nitroglycerin, about 0.50 gallons of process water are used per pound of product produced in the batch manufacturing process. Insofar as nitroglycerin is a dissolved pollutant, it is presumed to be carried by the streams without settling in reservoirs or lakes. The production of TNT also results in significant quantities of wastewater containing hexantrinitrodibenzyl, tetranitromethane, cyanic acid, trinitrobenzoic acid dinitrocresol, phenol, and various nitrotoluene sulfonic acids. Phossy water is a term for waters coming into direct contact with large quantities of molten phosphorus. When phossy water is discharged into a receiving water and an adequate time allowed, the white phosphorus particles may settle out and the dissolved phosphorus will slowly oxidize. (Baker-FRC)
W83-00441

BRIGHTEN THE BEDS,
C. A. Smith.
Effluent and Water Treatment Journal, Vol 22, No 6, p 231-232, June, 1982. 1 Tab.

Descriptors: *Public relations, *Wastewater facilities, *Cleanup, Fungi, Molds, Operating policies, Maintenance, Administration.

Due to increasing frequency of visits to wastewater treatment plants by visitor tour groups, different ways are explored of making the plant a more pleasant place to tour. In particular, the structures on and around the beds could be brightened up to look more presentable. One of the major problems is to select a paint that will resist microbe attack. Twenty species of mold were isolated when scientific tests were carried out, and a number of typical paint systems were selected and applied to toughened glass tubes in an atmosphere of an aqueous suspension of spores. Paints showing no growth after the two test periods were those containing zinc chromate, zinc oxide and phenolic resin/tung oil. The stability of fungicides has also been studied by brushing paints containing the fungicides and corresponding blanks on polyethylene - terephthalate polyester films which were attached to both sides of asbestos cement panels and exposed to humid conditions. The growth of mold has been found to be very much dependent on local environmental conditions, including food supply, humidity, temperature, and combinations of these. Use of mercurials and, to a lesser extent, phenolic biocides as assitives has provided adequate protection at reasonable cost. However, the toxicity of some of these compounds has produced some tragic incidents. In the treatment of mold which is already established, the surface should first be vacuum cleaned, brushed, and scraped, then washed down with 2% aqueous sodium pentachlorophenate followed by clean water, then dried. Dilute hypochlorite solution may also be suitable for mold growth treatment. (Baker-FRC)
W83-00442

DESTRUCTION OF POLLUTANTS IN WATER WITH OZONE IN COMBINATION WITH ULTRAVIOLET RADIATION. 1. GENERAL PRINCIPLES AND OXIDATION OF TETRACHLOROETHYLENE,
North Texas State Univ., Denton. Dept. of Chemistry.
For primary bibliographic entry see Field 5F.
W83-00446

UPRATING SLUDGE TREATMENT PROCESSES,
Water Resources Council Process Engineering, (England).
For primary bibliographic entry see Field 5E.
W83-00462

REMOVING METALS FROM WASTE SOLUTIONS WITH LOW RANK COALS AND RELATED MATERIALS,
Cullen (G. V.) and Associates, North Balwyn (Australia).
G. V. Cullen, and N. G. Siviour.
Water Research, Vol 16, No 8, p 1357-1366, August, 1982. 13 Tab, 20 Ref.

Descriptors: *Metals, *Coal, *Calcium hydroxide, *Wastewater treatment, Industrial wastewater, Ion exchange, Heavy metals, Peat, Sawdust, Lignite, Organic matter, Lime, Mine drainage, Metal-finishing wastes.

A method for removing metals from industrial wastes, such as mine drainage water and spent solutions and effluents from metallurgical and metal-finishing processes, was developed. Brown coal, peat, lignite, and sawdust were treated with lime slurry to load the carbonaceous media with Ca(++) ions, forming an ion exchange media. Optimum Ca loading was 19.1% on brown coal at 80 min contact time with lime slurry. The best loadings on other materials (1000 min contact time with a clarified Ca(++) solution) were sawdust, 8.6%; lignite, 10.9%; and peat, 12.4%. Metals removals from solutions at concentrations of 1000 mg or less on brown coal with Ca loading of 15.2%, contact time of 1000 min, and liquid:solid ration of 10:1 were 99.7% or greater for Zn, Pb, Cu, Al, Fe, Hg, Cd, U, Ni, Ag, and Co; 97.6% or greater for Mn, Ge, and Sb; and 92% for V. Cr(3+) and Cr(6+) were removed at 99.8% and 97.7%, respectively, at different contact times and liquid:solid ratios. The above conditions applied to Cu and the other carbonaceous materials produced removals of $>$ 99.2% for brown coal, lignite, sawdust, and peat. pH below 3 sharply decreased metals removals at higher loadings. Metals removals were on the order of 89-99.99% in treatment of 2 industrial wastes containing a combination of heavy metals in solution. Effluents contained metals levels comparable to those reported for other purification processes. The method may be applied either by stirring the Ca-loaded media in a batch of waste solution and filtering or by passing through packed beds in a contiuous process. (Cassar-FRC)
W83-00471

A SOLUTION TO SCREENINGS PROBLEMS BY DEWATERING AND INCINERATION,
Wessex Water Authority (England).
D. W. Pace, and G. J. Price.
Water Pollution Control, Vol 81, No 3, p 358-371, 1982. 2 Fig, 10 Tab, 1 Ref.

Descriptors: *Dewatering, *Incineration, *Filtration, Sludge disposal, Screens, Wastewater treatment, *England.

A screenings dewaterer was installed at Blackwell Hams Works, Chippenham, England, to handle severe blockages in the pressure filtration plant. Problems resulted from balling up of non-degradable plastics and man-made materials in the screenings. The apparatus is a rectangular welded steel frame 1 m high x 1.5 m wide x 4.6 m long on which is mounted a screening/washwater tank feeding in turn into a macerator, a pump, and the dewaterer itself. The dewaterer consists of 2 semicircular perforated steel plate drainage areas, the

first for draining excess water and the second for squeezing out further water with rubber rollers. The product looks like thin pieces of paper pulp about 100 mm x 50 mm x 3 mm, relatively free of fecal and organic matter. The screenings are bagged in plastic sacks and incinerated. Detailed operating data for the dewaterer and incinerator are given. (Cassar-FRC)
W83-00473

OXYGEN INJECTION INTO A RISING MAIN: ITS EFFECT ON PUMPING,
R. Carne, G. F. Clough, and S. Newcombe.
Water Pollution Control, Vol 81, No 3, p 399-411, 1982. 12 Fig, 3 Tab, 6 Ref.

Descriptors: *Oxygenation, *Pumping, *Energy loss, *Wastewater treatment, Hydrogen sulfide, Monitoring, Static head, Cost analysis, Operating costs, Pipes, Pipe flow, Bath, *England.

Oxygen injection into a sewage rising main produced good treatment results in the Bath, England, plant, but gas-locking in the main increased pumping costs by 50%. The oxygen was injected to control sulfide and to partially treat the sewage. Several conclusions were made after an investigation. Gas pockets could form at downward gradients with or without oxygen injection, but were larger with oxygen injection. This increased the static head, reduced pumping rates, and increased power consumption. Localized gas bubbles also increased losses and reduced pumping rates. The degree of gas-locking depended on: rate of oxygen injection, degree of oxygen dispersion at injection points, velocity of sewage flows, pump/pipeline characteristics, and air valve effectiveness. Power consumption was lowered to only 20% over the non-oxygen injection use by changing locations of the oxygen injection points and replacement of worn pump impellers. Other possible changes include modifying the pump control system, avoiding over-injection of oxygen, relocating the oxygen injection points, replacing existing air valves with more effective ones, and regular monitoring of pressure, flow, and power consumption. (Cassar-FRC)
W83-00474

FIRST IMPRESSIONS OF A NOVEL AERATION SYSTEM FOR ACTIVATED SLUDGE PLANTS,
A. P. Hopwood, and L. M. Barnes.
Water Pollution Control, Vol 81, No 3, p 412-424, 1982. 3 Fig, 9 Tab, 15 Ref.

Descriptors: *Activated sludge process, *Aeration, *Wastewater treatment, Biological wastewater treatment, Venturators, Isleham, *England, Nitrification.

The contact stabilization plant at Isleham, England, was modified by installation of Venturator aeration units to improve performance. There had been problems with low levels of nitrification, blocked lines, and excessive BOD loading. Four months of trials showed that dissolved oxygen of more than 1 mg per liter could be maintained, and the plant could be satisfactorily operated at twice the recommended BOD loading. Effluent quality was significantly improved: average suspended solids, 15 mg per liter, and BOD, 19 mg per liter. Nitrification was 50% and BOD removal, 92.2-97.6%. (Cassar-FRC)
W83-00475

A COMPARISON OF THE CARROUSEL AND PASVEER DITCH ACTIVATED SLUDGE PLANT,
Wessex Water Authority, (England).
C. R. Mulready, D. C. Payne, and D. W. Watkins.
Water Pollution Control, Vol 81, No 3, p 297-307, 1982. 6 Fig, 5 Tab, 6 Ref.

Descriptors: *Oxidation ditches, *Aeration, *Activated sludge process, Ditches, Carrousel ditches, Pasveer ditches, Dissolved oxygen, *Wastewater treatment, Performance evaluation.

Oxidation ditch installations at two activated sludge plants were compared. The Carrousel system produced a better and consistently higher quality effluent than the Pasveer ditch system. Although both are extended aeration systems, there are several differences. The Pasveer ditch system is a uniform channel 1.0-1.8 m deep. The aerator has a TNO rotor with rows of blades arranged around a horizontal center shaft, sited anywhere along the ditch. The depth of immersion is controlled by adjusting the outlet weir height. The Carrousel system is a uniform channel 2 m deep with 3 m deep aeration pockets. The vertical aerators, with eight vanes projecting from a center shroud, is above the deep section of the ditch. Depth is controlled by a jacking screw on the vertical shaft. In the Carrousel system the anoxic zones and dissolved oxygen were easier to control than in the Pasveer system. (Cassar-FRC)
W83-00476

DENITRIFICATION,
Metropolitan Sanitary District of Greater Chicago, IL.
T. B. S. Prakasam, and M. Krup.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 54, No 6, p 623-631, June, 1982. 122 Ref.

Descriptors: *Denitrification, *Literature review, *Wastewater treatment, *Water treatment, Soil bacteria, Sludge, Denitrifying bacteria, Bacteria, Microbiological studies, Slurries, Growth systems, Effluents, Patents, Water pollution control.

Publications covering major aspects of denitrification are reviewed. Several studies on the nature and behavior of denitrifying populations in soil, water, and wastewater ecosystems appeared, as well as investigations on conditions affecting the type and growth of bacteria in various types of sludge and wastewater. Studies of denitrification rates in coastal waters were noted. Works on slurry processes included reviews of the stoichiometry of denitrification and its significance in wastewater management, conditions affecting the denitrification rate, and the results of several denitrification systems. Attached growth processes reviewed included fixed beds, suspended growth systems, fluidized sand bed reactors, ion exchange, biological fluidized bed denitrification, blending with water from another source, provision of storage reservoirs to retain water of low nitrate from the same source, activated sludge, sand filters, the Ruck system, an upflow sludge blanket reactor utilizing the carbon found in wastewater, stirred bed reactors, and an immersed bed packed with plastic media. Soil denitrification studies covered conditions affecting denitrification rates, leaching, soil-turf filters, and the influence of Spartina alterniflora. Patents were issued for several attached and suspended growth systems, including denitrification processes using methanol as the hydrogen donor, the use of N2 gas evolved in the denitrification process to concentrate sludge by flotation, and a process in which a portion of the NH4-N in wastewater was subjected to ammonia stripping, while the remainder was nitrified and then denitrified. (Gish-FRC)
W83-00480

OPERATION AND MAINTENANCE OF WASTEWATER SYSTEMS INCLUDING INSTRUMENTATION AND AUTOMATION,
Lehigh Univ., Bethlehem, PA. Center for Marine and Environmental Studies.
I. J. Kugelman, J. Houthoofd, and W. Schuk.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 54, No 6, p 642-646, June, 1982. 73 Ref.

Descriptors: *Wastewater treatment, *Wastewater facilities, *Maintenance, *Operation, *Literature review, Automation, Process control, Training, Sensors, Pollutant identification, Model studies, Computers, Activated sludge.

Publications concerning the operation and maintenance of wastewater systems are reviewed. General papers comprised a literature review and two conferences, while recent studies focused on poor compliance with discharge standards and inadequacies in preliminary treatment, sludge handling, and instrumentation. Operator training was discussed in manuals on the skills needed by operators, suggestions for training programs, use of outside operation and maintenance consultants, and the role of training in start-up. Most studies on process control and operation of treatment processes focused on activated sludge. Reliance on grab samples, continuous measurement, dissolved oxygen control, on-line sludge sedimentation tests, and separate handling of waste activated and primary sludge were addressed. Instrumentation research covered the application of instrumentation to process control, sensors for in-line or on-line use in a wastewater treatment plant, flowmeters and other flow measurement procedures, and the problems of monitoring priority pollutants. Models of treatment processes included a nonlinear mathematical model of a six-unit treatment plant, time-dependent models of activated-sludge and nitrification systems, and stochastic models. Papers describing the application of computers for various functions were generally applicable to wastewater systems. Works on the use of computer control, operation, and maintenance also appeared. Miscellaneous publications considered odor control, foam control, and preventive maintenance programs. (Gish-FRC)
W83-00481

ONSITE ALTERNATIVES FOR TREATMENT AND DISPOSAL,
Wisconsin Univ.-Madison.
W. C. Boyle, and R. J. Otis.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 54, No 6, p 637-642, June, 1982. 50 Ref.

Descriptors: *Waste disposal, *Literature review, *Wastewater treatment, *On-site investigations, Domestic wastes, Animal wastes, Solid wastes, Developing countries, Subsurface disposal systems, Septic tanks, Path of pollutants, Wastewater management, Sanitation, Sewer systems, Wastewater facilities.

A literature review concerning the onsite treatment and disposal of wastes is presented. Two conferences, one in the U.S. and one in Nigeria, are cited. Onsite treatment studies included the application of flow-reduction methods, use of intermittent sand filters to treat household wastewater, characteristics of septage and the effects of its land application. Works on subsurface disposal systems focused on the attenuation of pollutants in soil, the performance of such systems, system design, and the rehabilitation of ineffective systems. Some works covered alternative systems made necessary by unfavorable topography and geology. These systems included mounds, narrow trenches, composting toilets, and subsurface, surface, and evaporation disposal methods. Management papers covered the current program for small alternative wastewater systems and the involvement of the EPA, along with guidelines on discrete sewerage facilities in the San Francisco Bay area. Publications on small community facilities were concerned with costs, selection of the most appropriate wastewater treatment techniques and optimum management. Thirteen works covered sanitation in developing countries and focused on guidelines and design tools for engineers and sanitarians; current knowledge on the health aspects of waste; the sociocultural aspects of water supply and excreta disposal; practical suggestions for sanitation in Vietnam and in Africa; evaluations of and treatment alternatives for current methods of waste management in developing countries; and the design of latrines and toilets. (Gish-FRC)
W83-00482

SLUDGE TREATMENT, UTILIZATION, AND DISPOSAL,
Duke Univ. Durham, Dept. of Civil Engineering.
For primary bibliographic entry see Field 5E.
W83-00483

BIOLOGICAL FILTERS,
Massachusetts Univ., Amherst. Dept. of Civil Engineering.
M. S. Switzenbaum.

Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 54, No 6, p 592-599, June, 1982. 1 Tab, 84 Ref.

Descriptors: *Wastewater treatment, *Biological filters, *Filters, *Literature review, Rotating biological contactors, Model studies, Nitrification, Energy, Anaerobic digestion, Stability analysis, Activated carbon, Fluidized beds, Aerobic treatment, Fermentation, Denitrification, Trickling filters.

The use of biological filters in wastewater treatment is reviewed. Ten works dealt with rotating biological contactors (RBC), several stressing the lower energy consumption of RBC compared with conventional activated sludge. The topic of nitrification with the RBC was covered, as was the use of RBC for industrial wastes and supplemental aeration and chemical feed to maintain optimal pH. Studies on anaerobic filters included the ANFLOW (anaerobic, upflow) procedure for the energy-efficient secondary treatment of municipal wastewater, the use of the anaerobic filter for energy production and pollution control of high-strength wastes, the stability of these filters under shock loading conditions, the advantages of anaerobic fixed film systems, and the use of anaerobic filters with granular activated carbon as the contact medium for phenol-containing wastewater treatment. Works on fluidized bed/expanded bed reactors considered aerobic systems, anoxic denitrification systems, or anaerobic fermentation systems. Articles on trickling filters included a forced-air down-draft filter with computer-controlled recycle for nitrification, filter performance, a simple method of analyzing retention time, the use of rigid PVC sheet material to replace rocks, and the characterization of oxygen transfer on filter slime. Fixed-film processes covered the effect of inorganic compounds in fertilizer-industry wastewater on nitrification and the wetting and stability of a plastic filter medium. Multistage systems were also discussed. (Gish-FRC)
W83-00484

LAGOONS AND OXIDATION PONDS,
Lubbock Christian Coll., TX. Inst. of Water Research.
D. B. George.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 54, No 6, p 610-612, June, 1982. 17 Ref.

Descriptors: *Lagoons, *Oxidation ponds, *Wastewater treatment, *Literature review, Design criteria, Performance evaluation, Stabilization ponds, Heavy metals, Animal wastes, Energy, Infiltration, Sand filters, Odor control, Suspended solids, Overland flow.

The use of lagoons and oxidation ponds in wastewater treatment is reviewed. A position paper on the regulation of waste stabilization pond systems evaluated effluent total suspended solids composition and its impact on reveiving waters. Net rainfall data, used for the design of lagoons for livestock-wastes treatment, were presented for 78 locations in 20 states. Works on process performance included the use of laboratory-scale two-cell lagoon systems to determine lagooning characteristics of swine and settled dairy waste; the effects of wastewater, water temperature and detention time on performance; an article indicating that heavy-metal accumulation was not a limiting factor in the design of oxidation ponds used to propagate tilapia; and several publications on the fate of pathogens in waste stabilization ponds. The section on upgrading of lagoons considered the energy requirements for alternative methods of treating wastewater flow rates of 190-19,000 cu m/day, a pilot rapid infiltration wastewater treatment system, the use of overland flow to upgrade municipal facultative lagoon effluent, the use of intermittent sand filters to increase performance, odor control methods, and oxygen sources for stabilization ponds. Two process models are reviewed: dye tracer studies and model simulations to predict the treatment efficacy of waste-stabilization-pond geometries and inlet and outlet configurations; and an optimization model to find the least-cost waste treatment facility design for a community that discharges into a stream with low drought stream flows. (Gish-FRC)
W83-00485

PHYSICAL AND CHEMICAL METHODS,
Florida Univ., Gainesville. Dept. of Environment Engineering Sciences.
E. L. Melear, and J. Zoltek, Jr.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 54, No 6, p 584-892, June, 1982. 140 Ref.

Descriptors: *Wastewater treatment, *Chemical treatment, *Physicochemical treatment, *Literature review, Coagulation, Flocculation, Sedimentation, Filtration, Flotation, Phosphorus removal, Adsorption, Activated carbon, Ion exchange, Membrane processes, Osmosis, Cellulose acetate membranes, Reverse osmosis, Oxidation, Wastewater oxidation.

General and specific aspects of physical and chemical methods of wastewater treatment are covered in this literature review. General articles concern treatment plants combining several methods, focusing on costs and on the theory and practice of ammonia stripping. Coagulation and solids separation was considered in theoretical presentations on flocculation/sedimentation systems and in works on the advantages of different chemicals for flocculation, the use of coagulation and flocculation for virus removal, settlers and sedimentation basins, direct filtration, flotation processes, and phosphorus removal. Adsorption was covered by papers presenting theoretical approaches to determining adsorption parameters; works on pilot studies, mathematical applications, and performance in the field of granular activated carbon used to remove organics; phenol adsorption studies; articles on the chemistry of activated carbon procedures; and works on adsorption onto such materials as type A zeolite, chelate resins, and aluminosilicate. Works on ion exchange included a history of the subject with an evaluation of its importance in water and wastewater treatment and new-process reports. Membrane process papers considered reverse osmosis, electrolyte osmosis, tubular membranes of cellulose acetate or polybenzimidazolone, ultrafiltration, and liquid membranes. Publications on oxidative processes included the use of ozone, treating wastewater effluents with chlorine dioxide, the Enercol and ZOP processes, and wet oxidation. (Gish-FRC)
W83-00486

DISINFECTION,
Illinois Inst. of Tech., Chicago. Pritzker Dept. of Environmental Engineering.
For primary bibliographic entry see Field 5F.
W83-00487

EFFECT OF EDTA ON CADMIUM IN ACTIVATED SLUDGE SYSTEMS,
National Cheng Kung Univ., Tainan (Taiwan). Dept. of Environmental Engineering.
J. F. Kao, L. P. Hsieh, S. S. Cheng, and C. P. Huang.
Journal of the Water Pollution Control Federation, Vol 54, No 7, 1118-1126, July, 1982. 12 Fig, 4 Tab, 13 Ref.

Descriptors: *Cadmium, *Chelation, *Accumulation, *Wastewater treatment, Toxicity, Water pollution effects, Activated sludge process, *Ethylenediamine tetraacetic acid, Kinetics, Bioaccumulation, Adsorption, Protein, Amino acids, Oxygen uptake.

Accumulation of Cd(++) in activated sludge was investigated in the absence and presence of ethylenediamine tetraacetic acid (EDTA), a strong chelating agent. In the absence of EDTA Cd(++) accumulated rapidly during the first stages of the experiments, 2-6 hours in the short-term runs (12 hours) and 5 days in the long-term runs (2-3 weeks). This was attributed to nonbiological adsorption of Cd(++) on the biosolids. Following the initial rapid rate of uptake (rate constants 0.44-0.71 per day for the long-term runs) the rate constant in the second stage remained at 0.08 per day. An adsorption isotherm (Cd(++) uptake vs. Cd(++) remaining in the supernatant) produced an S-shaped curve, indicating strong competition between water molecules and Cd(++) species and lateral interaction among adsorbed Cd(++) ions. EDTA addition at ratios of less than 1:1 molar decreased the extent of Cd(++) uptake one order of magnitude but did not affect the rate of uptake. At the molar ratio of 1:1 there was no inhibition of Cd(++) accumulation. The presence of a large quantity of Cd(++) in the sludge reduced COD removal efficiency and increased oxygen uptake rate, amino acid content, and protein content of the sludge. (Cassar-FRC)
W83-00489

OPERATING EXPERIENCE WITH THERMOPHILIC ANAEROBIC DIGESTION,
Los Angeles Bureau of Sanitation, CA.
W. F. Garber.
Journal of the Water Pollution Control Federation, Vol 54, No 8, p 1170-1175, August, 1982. 3 Fig, 3 Tab, 8 Ref.

Descriptors: *Anaerobic digestion, *Sludge digestion, Hyperion Plant, Los Angeles, *California, *Thermophilic digestion, Mesophilic digestion, Pathogens, Digestion, Dewatering, Soil amendments.

Thirty years operating experience in thermophilic digestion at the Hyperion Treatment Plant, Los Angeles, California, is reviewed. Operation was originally mesophilic (32-35C), but the decision to sell the sludge as a soil amendment prompted a switch to half mesophilic and half thermophilic in 1952. When ocean outfall disposal was started in 1957, the process was changed to 1 or 2 of the 18 digestion tanks at 49C and the balance at 32-35C. Since ocean dumping will be discontinued in 1985, the plant will be converted to 100% thermophilic digestion to provide good filtration properties and effective pathogen inactivation. Although 54C is a desirable temperature for pathogen inactivation, the Hyperion plant can presently maintain the required temperature differential of + or - 0.28C only at 49C. Design changes may make operation at 54 or 60C possible. (Cassar-FRC)
W83-00490

FACTORS LIMITING EMULSIFIED LIPID TREATMENT CAPACITY OF ACTIVATED SLUDGE,
Alberta Univ., Edmonton. Dept. of Civil Engineering.
S. E. Hrudey.
Journal of the Water Pollution Control Federation, Vol 54, No 8, p 1207-1214, August, 1982. 8 Fig, 2 Tab, 29 Ref.

Descriptors: *Food processing wastes, *Lipids, *Emulsions, Oil wastes, Grease, Activated sludge process, *Wastewater treatment, Settleability, Adsorption, Protozoa.

Factors limiting the treatability of emulsified lipids by the activated sludge process were evaluated by studying the rate of adsorption of lipids onto microbial floc, the effect of adsorbed lipids upon activated sludge settleability, and the interaction of emulsified lipids with stalked ciliated protozoa. A wastewater containing 400 mg per liter lipids was 80% adsorbed by acclimated activated sludge solids within 20-30 min. Batch settling data indicated that emulsified lipids promoted activated sludge settleability in acclimated sludge. An explanation for this may be the reduction of entrained water content by the lipid, providing a denser, more settleable floc. Stalked ciliates distinctly accumulated lipids in the experiments. Increasing the loading produced an immediate increase in ciliate population, showing their capability to feed directly on the lipid emulsion. Some useful observations relating to design and operation of activated sludge systems with high lipid loadings were obtained: adequate skimming of the secondary clarifier to prevent possible scum formation; a gentle mixing, flocculation stage between the aeration basin and quiescent settling basin; a 2-stage activated sludge process; and high aeration capacity as provided by

pure oxygen or deep shaft activated sludge processes. (Cassar-FRC)
W83-00499

EVALUATION AND COMPARISON OF DIGESTER GAS MIXING SYSTEMS,
Envirex Inc., Waukesha, WI.
P. G. Baumann, and G. L. Huibregtse.
Journal of the Water Pollution Control Federation, Vol 54, No 8, p 1194-1206, August, 1982. 16 Fig, 3 Tab.

Descriptors: *Anaerobic digestion, *Mixing, *Digestion, *Wastewater treatment, Draft tubes, Diffuser boxes, Lances, Performance evaluation.

Performance evaluation of several digester gas mixing systems indicated that each system was capable of maintaining uniform solids concentrations as well as preventing solids accumulation at the floor. The draft tube, multiple sequentially discharged lances, and floor-mounted diffuser boxes were studied under clean water conditions (in the laboratory) and active anaerobic digester conditions (in operating plants). The factors critical to successful mixing were depth of gas discharge and gas flow rate. The draft-tube and floor-mounted diffuser box systems were not as effective in controlling floating solids because energy input was confined to a limited area. The multiple sequentially discharged lance system required the least energy input to maintain proper mixing. Although the diffuser box system was not affected by changes in floating cover position, the inaccessibility of the boxes and piping during operation was a disadvantage. (Cassar-FRC)
W83-00500

SPRINKLER IRRIGATION ANSWERS CITY WASTE PROBLEM,
For primary bibliographic entry see Field 3C.
W83-00574

NEW SLUDGE SYSTEM REDUCES LANDFILLING NEEDS AT WEYERHAEUSER.
Pulp and Paper, Vol 56, No 7, p 124, July, 1982. 1 Fig.

Descriptors: *Activated sludge process, *Wastewater treatment, Pulp and paper industry, Sludge, Sludge dewatering, Waste disposal, Land application.

A new sludge treatment process at Weyerhaeuser Company's Rothschild, Wisconsin sulfite pulp and paper mill has reduced the amount of sludge cake hauled to landfill by as much as 70%. The process uses heat and pressure to partially oxidize wet sludge. Solids volume is reduced substantially and bound water is released to enhance dewaterability. A primary treatment system had been installed at the plant in 1975. Two years later a 10 million gallon/day secondary treatment system was added, consisting of two jet aeration channels, final clarifiers, sludge flotation thickeners, and three belt presses. These improvements reduced biochemical oxygen demand by 95% and suspended solids by 70%. A 20%-solids sludge cake was produced with the three presses. Sludge from the 1975-77 waste treatment system had been sent to a township landfill until that closed. The thermal conditioning system was installed, which produces a sludge cake acceptable to a professionally managed county landfill 15 miles away. Waste activated sludge is pumped to the thermal system at 3.5% solids. Compressed air at 375 psi is supplied to the sludge, which passes to a heat exchanger where it absorbs heat from the outgoing flow of the reactor. Preheated sludge then enters the reactor, where steam is used to raise its temperature to about 390 degrees F. The oxidized sludge then passes to a storage thickening tank for settling. The sludge is dewatered on only one belt press to 39% to 40% solids. This cake is then hauled to landfill. (Baker-FRC)
W83-00586

ANAEROBIC TREATMENT OF AN INDUSTRIAL WASTEWATER CONTAINING ACETIC ACID, FURFURAL, AND SULPHITE,
Kernforschungsanlage Jeulich G.m.b.H. (Germany, F.R.). Inst. fuer Biotechnologie 2.
G. Brune, S. M. Schoberth, and H. Sahm.
Process Biochemistry, Vol 17, No 3, p 20-22,24,35, May/June, 1982. 11 Fig, 3 Tab, 25 Ref.

Descriptors: *Anaerobic digestion, *Acids, *Sulfite liquors, *Wastewater treatment, Industrial wastewater, Acetic acid, Furfural.

Acid wastewater from a cellulose factory was treated in a continuous anaerobic digester. Composition of the vapor condensate influent was: acetic acid, 6-24 g per liter; furfural, 0.5-3 g per liter; sulfur, as sulfurous and sulfuric acids, 0.64-1.28 g per liter; COD, 10,000-20,000 mg 02 per liter; and pH, 1.6-1.7. An 85% reduction in COD and stable methane production rates were achieved at both 37 and 60C. In the start-up procedure the digesters were run as pH auxostats, where the activity of the bacteria governed the feed rate. Stable methane production of 0.35-0.4 cu m per kg COD consumed was achieved after 12-14 weeks. The retention time of 12 days (37C) and 14 days (60C) was decreased to 3-4 days by recycling the biomass by external sedimentation or by filtration. (Cassar-FRC)
W83-00587

SLUDGE INCINERATION WITH ENERGY RECOVERY,
For primary bibliographic entry see Field 5E.
W83-00608

WAYBILL SYSTEM IS A KEY TO INDUSTRIAL WASTE MANAGEMENT AND DISPOSAL,
For primary bibliographic entry see Field 5G.
W83-00611

SITE EVALUATION, DESIGN, OPERATION, AND INSTALLATION OF HOME SEWAGE SYSTEMS IN IOWA,
Iowa State Univ., Ames. Dept. of Agricultural Engineering.
C. E. Beer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-125245, Price codes: A04 in paper copy, A01 in microfiche. Iowa State Water Resources Research Institute Report ISWRRI-93, Ames, June, 1982. 63 p, 67 Fig, 17 Tab, 47 Ref, 1 Append. OWRT A-064-IA(1), 14-34-0001-7034.

Descriptors: *Wastewater treatment, *Waste disposal, *Sewer systems, *Wastewater facilities, *Design criteria, *Iowa, Groundwater quality, On-site investigations, Sewers, Sorption, Effluents, Waste load, Wastewater disposal, Wastewater pollution, Absorption, Field wastes, Percolation rate, Construction methods.

Investigations were carried out to develop information for solving problems associated with the design, location, and maintenance of on-site waste treatment systems for dwellings. Three specific activities were undertaken. One focused on the development of information concerning the origin, description, and classification of soils, and on how the soil properties/characteristics related to proper site evaluation for optimum waste treatment. A second activity examined Iowa groundwater districts and assessed the geology and location of the water resources relative to potential pollution hazards associated with waste treatment systems. A third study area developed guidance for selecting design criteria and construction methods for on-site waste treatment systems. The research findings and an extensive literature review are combined to provide information on both conventional and alternative systems for sanitarians, extension personnel, and contractors for on-site waste treatment systems. Research has shown that the adsorption field life can be lengthened if the entire absorption area receives effluent simultaneously. It is recommended that a dosed-alternating field can be used in soils having a percolation rate of 60-120 minutes/inch at proper design intake rates. (Zielinski-MAXIMA)
W83-00621

DEVELOPMENT OF A COUNTYWIDE MODEL MANAGEMENT ORGANIZATION FOR WASTEWATER,
Iowa State Univ., Ames. Dept. of Agricultural Engineering.
C. E. Beer, and K. M. Mancl.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-125252, Price codes: A06 in paper copy, A01 in microfiche. Iowa State Water Resources Research Institute Report ISWRRI-106, Iowa State University, Ames, July 1982. 101 p, 9 Fig, 3 Tab, 39 Ref, 3 Append. OWRT A-069-IA(1), 14-34-0001-9017.

Descriptors: *Wastewater management, *Sewer systems, *Surveys, *Septic wastewater, *Water analysis, Groundwater quality, Nitrates, *Wastewater treatment, Waste disposal, Wastewater facilities, Sewers, Sorption, Effluents, Waste load, Wastewater disposal, Wastewater pollution, Absorption, *Iowa, Water districts.

A model county ordinance to establish on-site wastewater management districts in Iowa counties was prepared, distributed to all 99 counties, and adopted by Guthrie County, creating a management district at Lake Panorama. Based on the acceptance, accomplishments, and few difficulties experienced at Lake Panorama, public management of on-site wastewater treatment systems is a workable, realistic alternative for rural Iowa. The problems encountered by the district and how they are handled have been presented and analyzed. High density use of on-site wastewater treatment systems in a rural subdivision in Polk County was also examined. Septic systems were investigated for evidence of failure, house-to-house surveys were performed, and well-water samples were analyzed. It was concluded that septic systems can operate satisfactorily for over 20 years. Only one of 68 well-water samples contained fecal coliform bacteria. Bacteria can be effectively removed through subsurface disposal of effluent even in a sandy loam to loamy sand under very high density development. Groundwater contamination by nitrate through subsurface disposal can, however, present a problem. Thirty-six samples exceeded the nitrate standard with the highest being 25.6 mg/liter nitrogen. (Zielinski-MAXIMA)
W83-00622

EVALUATION OF THE PERFORMANCE OF A COMBINED SEWER OVERFLOW RETENTION TANK,
Ontario Ministry of the Environment, Toronto.
W. Wong, and G. Zukovs.
Research Publication No 90, July 1982. 48 p, 10 Fig, 6 Tab, 6 Ref. 2 Append.

Descriptors: *Combined sewer overflows, *Holding tanks, *Water quality control, *Wastewater management, *Storm runoff, *Municipal wastewater, Overflow, Overflow channels, Storage tanks, Water tanks, Water storage, Waste disposal, Waste storage, *Toronto, Wastewater treatment, Evaluation, Wastewater collection, Storm sewers, Urban runoff, Ontario.

The performance of a combined sewer overflow tank in urban Toronto (capacity, 1.63 million Imperial gallons (IMG) was studied during the summers of 1977 and 1978 (covering 276 study days) during which 50 storms occurred. Thirty-three storm events produced inflow to the tank, of which 17 were wholly retained by the tank and the remainder represented a total 102.3 IMG overflow to Black Creek. Use of the tank reduced the overflow volume by 18%, and reduced pollutant loadings for BOD, solids, and nutrients (nitrogen and phosphorus) by an average of 38-47% of the total influent loading. The tank was, hence, found to be an effective device for reducing pollution from combined sewer overflow. The tank outlet barrier further removed essentially all floating material from the overflow to the Creek, greatly enhancing the aesthetic quality of the overflow. Coliform and enterococcus levels were measured for the tank inflow, but not at the tank outlet. Sediment accumulated in the tank after storms was generally 1-2 inches deep; larger solids were physically removed by shovel. The study results should benefit municipalities faced with controlling combined sewer

overflows, and aid the design and compliance monitoring of similar future facilities. (Zielinski-MAXIMA)
W83-00627

MODEL PROTOCOL FOR THE COMPREHENSIVE EVALUATION OF PUBLICLY OWNED TREATMENT WORKS PERFORMANCE AND OPERATION,
Gannett, Fleming, Corddry and Carpenter, Inc., Harrisburg, PA.
H. D. Roberts, A. C. Gray, Jr., P. E. Paul, and J. M. Houthoofd.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-180480, Price codes: A06 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S2-82-015, May 1982. 3 p. 68-03-2571.

Descriptors: *Evaluation, *Municipal wastewater, *Wastewater treatment facilities, *Performance evaluation, Design criteria, Monitoring, Maintenance, Administration, Standards.

A large percentage of municipal wastewater treatment plants do not meet design expectations and are not in compliance with their National Pollution Discharge Elimination System permit standards. A systematic approach to conducting a comprehensive performance evaluation of municipal wastewater treatment plants was developed. The objective of the evaluation is to identify and rank the causes of poor plant performance. Five major problem areas are addressed: design, performance monitoring, operation, maintenance, and administration. By following this protocol, an evaluation team will be able to identify deficiencies in each of the five categories, weigh them with respect to adverse impact on plant performance, and rank them in order of severity of impact. The preparatory steps to be completed before the actual plant visit include: notification of treatment works personnel and municipal officials; estimation of time, labor, materials, and money required to conduct the evaluation; and formulation of the field sampling and analytical program. The evaluation protocol has been prepared as a user-oriented field document that provides specific guidance for conducting comprehensive plant evaluations and identifying problems and solutions to improve plant performance. (Moore-SRC)
W83-00631

PERFORMANCE OF TRICKLING FILTER PLANTS: RELIABILITY, STABILITY AND VARIABILITY,
California Univ., Davis.
R. Haugh, S. Niku, E. D. Schroeder, and G. Tchobanoglous.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-108143, Price codes: A06 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S2-81-228, December 1981. 13 p, 3 Fig, 5 Tab. R805097-01.

Descriptors: *Trickling filters, *Wastewater treatment, *Effluents, *Biochemical oxygen demand, *Suspended solids, *Performance evaluation, Statistical analysis, Variability, Reliability, Regression analysis, Seasonal variation.

Effluent quality variability from trickling filters was examined in this study by statistically analyzing daily effluent BOD5 and suspended solids data from 11 treatment plants. Summary statistics (mean, standard deviation, etc.) were examined to determine the general characteristics of those data. Distributions of most effluent data were skewed to the right, and daily suspended solids data generally exhibited more variation than daily BOD5 data. Five probability distribution functions, chosen through experience and the literature, were tested to determine which would be best used to describe daily, 7-day average and 30-day average effluent data distributions. Three distributions (the two parameter empirical, the gamma, and the log normal) were found to be adequate, with the log normal being preferred because of the ease of application. Daily effluent BOD5 and suspended solids data were found to contain both random and nonrandom components. Weekly cycles are found in about half of the plants studied, and significant month-to-month variation in effluent quality was found in every plant. Effluent BOD and suspended solids concentrations were higher in winter than in summer when pooled data from all plants were examined. Multiple regression analysis was used to determine the effects of various process parameters on effluent quality. In general, primary effluent BOD5 and suspended solids concentrations and wastewater temperature had the greatest effect. Variation due to measurement error was estimated to be 5 to 78% and 11 to 78% for effluent BOD5 and suspended solids values, respectively. Methods for incorporating statistical concepts into trickling filter design and operation are discussed. (Author's abstract)
W83-00634

PILOT PLANT STUDY ON SEWAGE SLUDGE PYROLYSIS-I,
NGK Insulators Ltd., Nagoya (Japan).
For primary bibliographic entry see Field 5E.
W83-00647

COST-EFFECTIVE PROGRAM FOR COMBINED SEWER OVERFLOW ABATEMENT,
O'Brien and Gere Engineers Inc., Syracuse, NY.
For primary bibliographic entry see Field 5G.
W83-00659

STABILITY OF CHLORINE DIOXIDE IN AQUEOUS SOLUTION,
Barcelona Univ. (Spain).
M. Medir, and F. Giralt.
Water Research, Vol 16, No 9, p 1379-1382, September, 1982. 3 Fig, 10 Ref.

Descriptors: *Chlorine dioxide, *Kinetics, *Disinfection, Wastewater treatment, Decomposition, Oxidation.

Chloride dioxide (0.002-0.04 mol per liter) in unbuffered solutions at pH 9 and 25C decomposed to chlorate, chlorite, chloride, and oxygen in the proportions 5:3:1:0.75, respectively. These products were dissimilar to those formed by chlorine dioxide decomposition in strong alkaline medium in buffered solution: chlorate, chlorite, and hydrogen ion. Two reactions, an initial slow reaction and a subsequent fast reaction, were seen in the unbuffered solution. The initial rate of the slow reaction in water was pseudo first-order with a rate constant of 0.0003 per min, and in 0.65-0.9 mol per liter sodium sulfate solutions, 0.00087 per min. The length of the slow reaction period decreased with chlorine dioxide initial concentrations. At 0.00317 mol per liter chlorine dioxide, about 10% decomposed by 600 min and 80% by 1000 min. Addition of sodium chloride solutions (0.1-0.8 M) to 0.02-0.02 mol per liter chlorine dioxide reduced the stable period to a few minutes; 10% of chlorine dioxide decomposed within an hour and 70% within 400 min. Chloride ion also slowed down the second reaction and changed the product distribution to a 1:1 molar ratio, increasing the oxidizing potential of chlorine dioxide. In buffered solution at pH 8.8 the reaction was pseudo second-order, producing chlorate and chlorite. (Cassar-FRC)
W83-00667

THE EFFECT OF WATER HARDNESS ON NITRILOTRIACETATE REMOVAL AND MICROBIAL ACCLIMATION IN ACTIVATED SLUDGE,
Procter and Gamble Co., Cincinnati, OH.
R. D. Vashon, W. J. Jones, and A. G. Payne.
Water Research, Vol 16, No 9, p 1429-1432, September, 1982. 3 Tab, 29 Ref.

Descriptors: *Activated sludge process, *Nitrilotriacetic acid, *Hardness, *Wastewater treatment, Acclimatization, Biodegradation, Degradation, Biological treatment, Detergents.

Water hardness had little effect on nitrilotriacetic acid (NTA) removal in 4 laboratory-scale activated sludge reactors. After acclimatization > 90% NTA removal was observed. The times to reach 60% and 90% NTA removal were: hard water (250 mg per liter as CaC03, pH 7.4), 8 and 15 days, respectively; and soft water (50 mg per liter as CaC03, pH 6.4), 20 and 28 days, respectively. During the acclimatizing period NTA-utilizing bacteria increased 100-fold. The rate of increase of these bacteria was faster in hard water than in soft water and faster in semicontinuous reactors than in continuous reactors. Average ultimate biodegradation of NTA in the acclimatized units as measured by C14-labeled NTA was 89.9 + or - 4.7% in soft water and 86.2 + or - 4.7% in hard water. Less than 1% accumulated in the sludge. (Cassar-FRC)
W83-00668

STABILITY AND PERFORMANCE OF ANAEROBIC FIXED FILM REACTORS DURING HYDRAULIC OVERLOADING AT 10-35C,
National Research Council of Canada, Ottawa (Ontario). Div. of Biological Sciences.
K. J. Kennedy, and L. van den Berg.
Water Research, Vol 16, No 9, p 1391-1398, September, 1982. 8 Fig, 5 Tab, 16 Ref.

Descriptors: *Anaerobic digestion, *Hydraulic loading, *Shock loads, *Wastewater treatment, Performance evaluation, Temperature effects, Fixed film digesters.

Laboratory anaerobic fixed film reactors severly overloaded to 94 kg COD per cu m per day for 24 hours returned to normal performance within 12-48 hours after overloading. Three types of wastewater were used: bean blanching waste, chemical industry waste (mostly short chain volatile fatty acids and ammonia), and heat treated sewage digester sludge. Overloading decreased COD removal and increased volatile fatty acids concentrations, the amount of reduction depending on the temperature and type of waste. Methane production decreased soon after overloading, then increased slightly for the duration of the upset. After overloading, methane production increased dramatically to a new steady state and slowly returned to normal levels as the excess fatty acids were converted. The proportion of carbon dioxide in the digester gas was also increased during the overload. Overloading at operating temperatures of 10,25 and 35C showed that COD removal and methane production was less at the lower temperatures. The repeated overloads increased the loading capacity of the reactors by 5-10%. (Cassar-FRC)
W83-00670

DEVELOPMENT OF A SETTLING MODEL FOR PRIMARY SETTLING TANKS,
Singapore Univ. Dept. of Civil Engineering.
J.-H. Tay.
Water Research, Vol 16, No 9, p 1413-1417, September, 1982. 4 Fig, 3 Tab.

Descriptors: *Primary wastewater treatment, *Suspended solids, *Settling tanks, *Wastewater treatment, Model studies, *Ontario.

A settling model was developed from data on settling characteristics of wastewater suspensions and the hydraulic characteristics of the primary settling tanks at three Ontario wastewater treatment plants. Data was obtained from settling column tests, tracer studies, and removal efficiencies of suspended solids. Flow rates were variable, and ferric chloride and polymer were added on some occasions. Half-removal times (the time at which 50% of influent suspended solids is removed) were 3 and 9 times shorter for addition of ferric chloride and ferric chloride with polymer, respectively, than for no chemical addition. Data on suspended solids removal from other researchers agreed well with model predictions. (Cassar-FRC)
W83-00671

COMPARATIVE EVALUATION OF MATHEMATIC MODELS USED FOR CALCULATING AERATION TANKS,
V. A. Vavilin, and V. S. Vasil'ev.
Water Resources, Vol 8, No 4, p 420-431, July/August, 1981. 3 Fig, 8 Tab, 30 Ref. Translated

from Vodnye Resursy, No 4, p 132-145, July/August, 1981.

Descriptors: *Model studies, *Aeration tanks, Mathematical models, *Wastewater treatment, Activated sludge process, Oxidation, Biological treatment, Design criteria.

Twenty mathematical models for calculating aeration tanks for wastewater treatment processes, including four empirical models proposed by the authors, are compared. For single substance substrates biological oxidation is well described by the classical Monod type microbiological models, the limiting cases of which are reactions of zero and first order. For multicomponent waters, models using higher orders of reaction are more adequate, in particular, a model of a second-order reaction containing one constant. The oxidation rate constant in the mixer can be higher than in the displacer. For a multistage aeration tank the formal nth order models can be inapplicable, designating that the volume of the stages of the tank should decrease in the direction of the flows. (Cassar-FRC)
W83-00672

USE OF A KINETIC STUDY TO OPTIMIZE THE ACTIVATED SLUDGE PROCESS,
Naval Facilities Engineering Command, Pearl Harbor, HI. Pacific Div.
P. R. Vasicek.
Journal of the Water Pollution Control Federation, Vol 54, No 8, p 1176-1184, August, 1982. 10 Fig, 1 Tab, 11 Ref.

Descriptors: *Activated sludge process, *Kinetics, *Shock loads, Wastewater treatment, Fort Kamehameha, Pearl Harbor, *Hawaii, Mathematical models, Model studies, Performance evaluation, Sludge, Oxygen uptake.

Activated sludge process parameters and wastewater quality parameters were studied in a 3-month experiment using effluent from a primary clarifer at Fort Kamehameha Treatment Works at Pearl Harbor, Hawaii. The food/microorganism ratio was varied up to 0.4 as BOD5. Kinetic design constants were determined using the steady-state mathematical models for substrate removal, sludge production, and oxygen utilization. The constants and their BOD5 and COD based values were listed. Constants were: substrate utilization rate constants, yield coefficients, and endogenous respiration rates. Application of the constants to the Ft. Kamehameha plant operation suggested process adjustments such as a change of plug flow wastewater input to a modified contact stabilization process and reduction of the food/microorganisms ratio and hydraulic retention time. These changes helped eliminate upsets from shock loads introduced into a normally weak-strength wastewater influent. (Cassar-FRC)
W83-00677

5E. Ultimate Disposal Of Wastes

HEALTH EFFECTS ASSOCIATED WITH WASTEWATER TREATMENT AND DISPOSAL,
Cincinnati, Ohio, Health Effects Research Lab., Cincinnati, OH.
For primary bibliographic entry see Field 5C.
W83-00371

UPRATING SLUDGE TREATMENT PROCESSES,
Water Resources Council Process Engineering, (England).
A. M. Bruce, and C. F. Lockyear.
Water Pollution Control, Vol 81, No 3, p 425-443, 1982. 9 Fig, 32 Ref.

Descriptors: *Sludge thickening, *Sludge digestion, *Dewatering, Reviews, Sludge solids, Sludge filters, Sludge cake, Sludge conditioning, Anaerobic digestion, Polyelectrolytes, Denitrification, Retention time, Mixing, Filtration, Filter rate.

Several processes for uprating the performance of sludge treatment woithout increasing the plant size or capacity are available. This paper discusses gravity thickening, anaerobic digestion, and mechanical dewatering. Gravity thickener performance may be improved by increasing the rate of thickening. Insufficient retention time may be corrected by polyelectrolyte addition or conversion to continuous operation. Excessive biological activity, resulting in sludge flotation, may be solved by addition of polyelectrolyte, installation of picket fences, denitrification of sludge by adding a carbon source, and stabilization of sludge by gamma irradiation or addition of lime, clay, or fly ash. Upgrading an anaerobic digester should first consider if any inhibitory substances are present in the raw sludge. Performance of unheated digesters can be improved by installing mixing and heating in winter. The mesophilic anaerobic plants may be made more efficient by increasing retention time, increasing the solids content up to 9-10%, sludge pre-thickening before digestion, optimizing heat exchange, providing supplemental heat in winter, and improving mixing. Dewatering processes involve filter pressing and belt pressing. In filter pressing the rate of filtration may be increased by thickening the feed sludge, reducing the sludge volume to be dewatered, installing rubber drainage surfaces to facilitate dislodging of trapped cake, and using membrane presses. The belt pressing process may be uprated by increasing sludge throughout. (Cassar-FRC)
W83-00462

VACUUM TECHNOLOGY AND ITS APPLICATION IN THE WATER INDUSTRY,
General Vacuum Services, West Midlands (England).
F. R. Furlong.
Water Services, Vol 86, No 1036, p 276, 279, June, 1982.

Descriptors: *Sludge disposal, *Pumping, Suck and blow system, Water industry, Sludge lagoons, Vacuum technology.

A vacuum system was designed to convey sludges and waste products from water and wastewater treatment. Known as the SB system (suck and blow), it produces a continuous high vacuum (28 in Hg) with a low air flow using pneumatically controlled and operated sensors to govern the length of time to complete each cycle. The equipment is capable of 30 m lifts and 500 m horizontal conveyance. Improvements being developed will improve performance through better handling of lighter materials and an intake device which breaks down solids prior to removal. The apparatus may also be developed for use in sewer cleaning. (Cassar-FRC)
W83-00468

ONSITE ALTERNATIVES FOR TREATMENT AND DISPOSAL,
Wisconsin Univ.-Madison.
For primary bibliographic entry see Field 5D.
W83-00482

SLUDGE TREATMENT, UTILIZATION, AND DISPOSAL,
Duke Univ. Durham, Dept. of Civil Engineering.
P. A. Vesilind.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 54, No 6, p 631-637, June, 1982. 151 Ref.

Descriptors: *Sludge, *Sludge disposal, *Sludge utilization, *Literature review, Sludge drying, Sludge digestion, Sludge thickening, Rheology, Wastewater treatment, Wastewater management, Incineration, Waste disposal, Digestion, Biodegradation, Land disposal.

A literature review is presented concerning several aspects of sludge treatment, use, and disposal. A document on research needs in sludge management considers the lack of planning, various engineering concerns, and lack of adequate technology that causes treatment and disposal problems. Several papers recognized that sludge management was a regional problem solvable by a systems approach. Publications discussing sludge properties focused on sludge particle size and sludge rheological characteristics. Works covering thermal treatment and incineration were included. Sludge thickening was the subject of some innovative papers, including a discussion of the design of the sludge removal mechanism, a description of a fluxmeter used to determine automatically the movement of solids in a batch settling test, a comparison of thickening theories, and thickening models. Works on dewatering included a survey of fundamental principles, descriptions of dewatering practices in Europe, various aspects of centrifugal dewatering, problems and design of vacuum filters, the formation of filter cakes, and studies on the diaphragm filter press. Stabilization papers considered principles of sludge decomposition, pathways of sludge stabilization on land, anaerobic digestion, separate digestion of primary and secondary sludges, dual digestion, composting, the destruction of pathogens, and the problems of floating sludge and odor control. Several review articles on sludge disposal on land appeared. Other works on ultimate disposal and utilization covered the quality of leachates from different sludges, sludge transport, the movement of PCBs and chlorinated hydrocarbon pesticides in a treatment plant, the effects of heavy metals in sludge, and the effect of sludge application on the growth of various organisms. (Gish-FRC)
W83-00483

OPERATING EXPERIENCE WITH THERMOPHILIC ANAEROBIC DIGESTION,
Los Angeles Bureau of Sanitation, CA.
For primary bibliographic entry see Field 5D.
W83-00490

GROUND-WATER POLLUTION INVESTIGATIONS IN THE GREAT OUSE BASIN. II-SOLID WASTE DISPOSAL,
For primary bibliographic entry see Field 5B.
W83-00507

NEW SLUDGE SYSTEM REDUCES LANDFILLING NEEDS AT WEYERHAEUSER.
For primary bibliographic entry see Field 5D.
W83-00586

SLUDGE INCINERATION WITH ENERGY RECOVERY,
J. H. Mulholland.
Water and Pollution Control, Vol 120, No 4, p 13-14, July/August, 1982. 1 Fig.

Descriptors: *Fluidized beds, *Incineration, *Sludge utilization, *Solid waste disposal, *Waste recovery, Fluidized bed process, Sludge disposal, Waste disposal, Recycling, Wastewater facilities, Wastewater treatment, Water pollution control, Toronto, *Ontario.

The Duffin Creek Water Pollution Control Plant Incineration Facility is thought to be the largest operational fluidized bed sewage sludge incineration/waste energy facility in the world. The plant will be expanded in four stages to have a capacity of 740,000 cu meters/day. The incinerator/boiler building includes incinerators, waste heat recovery boilers, auxilliary steam boilers for start-up and emergency use, plant process and building heating services, air pollution scrubbing system and stack. A steam turbine provides power to the combustion air blower which draws air from the adjacent dewatering building and compresses it to 40 kPa and then passes it through the heat exchanger where it is heated before entering the fluid bed. Dewatering sludge is fed into the sand bed where it ignites to keep the sand at 820 degrees. In addition to several energy saving aspects, the plant also features belt filter presses to mechanically dewater the sludge with more than an 80% reduction in electrical power requirements over conventional vacuum filter installations. The Stage I Capital Works incorporates design features for future energy recovery and conservation and can be expanded to accommodate 4 incinerator systems and two 2,000 kW steam turbine generators. (Geiger-FRC)
W83-00608

COMPOSTING SEWAGE SLUDGE BY MEANS OF FORCED AERATION,
L. S. Ramano.
Water and Pollution Control, Vol 120, No 4, p 26-28, July/August, 1982.

Descriptors: *Composting, *Sludge disposal, *Sludge utilization, *Landfills, Recycling, Solid waste disposal, Waste recovery, Aeration, Sludge drying, Sludge cake, Humus sludge, Windsor, Ontario.

The City of Windsor began to look for new ways of disposing of sewage sludge after the closing of its sanitary landfill sites in the summer of 1973. The static aerated rapid composting process that was developed by the United States Department of Agriculuture at its research laboratories in Beltsville, Maryland was evaluated using sludge produced in West Windsor. The trials proved the method to be satisfactory for composting using wood chips as the bulking agent. The compost will be used to convert a landfill on the city's west side to a park and a golf course. The West Windsor Pollution Control Plant was chosen for composting, and the compost was located on plant property. All leachate and runoff from the compost pile was channeled into a sanitary sewer. Temperature and oxygen levels are measured periodically in the curing piles, which are broken down after 30 days of composting. The compost is then screened to recover 80% of the original wood chips before being used in park redevelopment and right-of-way restoration. The cost to compost the sludge cake is slightly less than $11 per ton. The West Windsor compost will be used in trials on corn plots near Ridgetown, Ontario, as a source of humus. Compost helps prevent wind erosion of sandy soils, is good for quick grass growth, and is useful as a landfill material. While composting of sludge cake is labor-intensive, it may prove to be more economical in the long run than other sludge cake disposal methods. (Geiger-FRC)
W83-00614

LARGE SUBSURFACE SEWAGE DISPOSAL SYSTEMS,
For primary bibliographic entry see Field 5B.
W83-00626

PHYSICAL AND CHEMICAL CHARACTERISTICS OF SYNTHETIC ASPHALT PRODUCED FROM LIQUEFACTION OF SEWAGE SLUDGE,
Battelle Northwest, Richland, WA.
J. M. Donovan, R. K. Miller, T. R. Batter, and R. P. Lottman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-119082, Price codes: A04 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S2-81-242, December 1981. 7 p, 1 Fig, 4 Tab. R-806790-01.

Descriptors: *Sludge utilization, *Liquefaction, *Thermochemical processes, Cost analysis, Sludge disposal, Feasibility studies, Fuel, Wastewater treatment.

Alternative technologies for sewage sludge disposal need to be energy efficient and, if possible, some product of value should be recovered from sludge. Direct thermochemical liquefaction of primary undigested municipal sewage sludge was carried out to produce a low molecular weight steam-volatile oil, a high molecular weight synthetic asphalt, and a residual char cake. The latter product is capable of supplying the thermal energy requirements of the conversion process. The steam-volatile oil has immediate value as a synthetic fuel oil. The synthetic asphalt may prove to be a useful cement for paving with further research, or it can be used as a fuel or coking stock. It is outwardly similar to petroleum asphalt, but chemically different. The thermochemical liquefaction process should be capable of operating in a technically and environmentally acceptable manner in conjunction with many wastewater treatment facilities. The overall feasibility of the process depends on the value of the oil and synthetic asphalt products as petroleum replacements and on the costs associated with disposal of sludge. Projected economics indicate that the process has considerable promise for many potential sites in the United States at the present time. (Moore-SRC)
W83-00636

SURVEY OF ON-GOING AND COMPLETED REMEDIAL ACTION PROJECTS,
SCS Engineers, Covington, KY.
For primary bibliographic entry see Field 5G.
W83-00637

PILOT PLANT STUDY ON SEWAGE SLUDGE PYROLYSIS-I,
NGK Insulators Ltd., Nagoya (Japan).
T. Kasakura, and M. Hiraoka.
Water Research, Vol 16, No 8, p 1335-1348, August, 1982. 6 Fig, 12 Tab, 10 Ref.

Descriptors: *Sludge dewatering, *Pyrolysis, *Wastewater treatment, Incineration, Sludge disposal, Waste disposal, Activated sludge process, Pilot plants.

The performance of drying-pyrolysis process in pilot scale was evaluated and the efficiency of the operation as a thermal processing of sewage sludge was demonstrated. A comparison was made of the drying-pyrolysis process with other thermal processes of sewage sludge and the feasibility of the practical plant of drying-pyrolysis process was demonstrated. Pyrolysis is defined as thermal processing which decomposes the solids containing organic compounds into three parts: combustible pyrolytic gas and combustion gas; pyrolytic oil, organic acid and water; and residue containing char and ash, at the temperature ranging from 500 to 1000C. Waste water from such operations arises primarily from scrubbing operations which always serve as a pretreatment for cooling and dehumidifying of exhaust gas. Some portion of the pollutants transfer into the liquid phase. Characteristics of waste water vary with the type of scrubbing equipment and liquid to gas ratio. It is concluded that the pyrolysis process offers a solution for problems of secondary pollution in thermal processings and of large energy consumption. (Baker-FRC)
W83-00647

INTERLABORATORY TESTING OF THE LEACHABILITY OF WASTES AND SLUDGES (RINGVERSUCHE ZUR BESTIMMUNG DER ELUIERBARKEIT VON ABFALLEN UND SCHLAMMEN MIT WASSER),
For primary bibliographic entry see Field 5B.
W83-00650

EFFECT OF LIQUID WASTEWATER SLUDGE APPLICATION ON CROP YIELD AND WATER QUALITY,
Science and Education Administration, St. Paul, MN.
D. R. Duncomb, W. E. Larson, C. E. Clapp, R. H. Dowdy, and D. R. Linden.
Journal of the Water Pollution Control Federation, Vol 54, No 8, p 1185-1193, August, 1982. 1 Fig, 8 Tab, 10 Ref.

Descriptors: *Land disposal, *Crop yield, *Nutrients, Fate of pollutants, Corn, Grasses, Agriculture, Nitrates, Phosphates, Groundwater pollution, Trace metals, Water quality, *Minnesota.

Liquid digested wastewater sludge was applied to a 16 ha terraced experimental watershed at Rosemount Agricultural Experiment Station, Minnesota, during the years 1974-79. A total of 73.9 metric tons per ha were applied to an area cropped to corn, and 85.2 metric tons were applied to an area cropped to reed canary grass. Total amounts of nutrients were 4160, 2060, and 320 kg of N, P, and K, respectively, on corn and 4810, 2050, and 410 kg of N. P. and K, respectively, on the canarygrass. Mean corn grain yields (1976-79) were 10.4 metric tons per ha; grass yields were 10.9 metric tons per ha. Of the applied N, 26% and 34% were removed by the corn and grass, respectively in 1976-79. Nitrate concentrations in soil water at the 150 cm depth were 61-262 mg per liter under corn areas and 20-69 mg per liter under grass. The differences in nitrate levels between the 2 crop areas were associated with the higher N demands of reed canarygrass. No significant increases in phosphate or trace metals levels were detected in plant tissue or soil water at any depth with any treatment. (Cassar-FRC)
W83-00656

BENTHAL STABILIZATION OF WASTE ACTIVATED SLUDGE,
Clemson Univ., SC. Dept. of Environmental Systems Engineering.
L. G. Rich, and B. W. Connor.
Water Research, Vol 16, No 9, p 1419-1423, September, 1982. 4 Fig, 3 Tab, 18 Ref.

Descriptors: *Sludge digestion, *Stabilization lagoons, Activated sludge, Anaerobic digestion, Sludge solids, Benthal stabilization, Digestion, Methane.

Benthal stabilization of waste activated sludge solids was studied for 42 weeks in a 10 ft tall, 8 in diameter laboratory column. Sludge suspensions were added to the top of the water-filled column twice a week. Average loading rate was 56.8 g per sq m per day of solids. After the solid material settled to the bottom, the overlying water was aerated. The system was stable and odor-free as long as dissolved oxygen was maintained in the water column. An average benthal stabilization rate (in terms of biodegradable solids) of 79.4 g per sq m per day was attained at temperatures of 20 + or - 1C and if solids were not limiting. Components of the stabilization rate (in g per sq m per day) were 49.8 for methane production, 18.7 for direct oxygen uptake, and 10.9 for BOD 5 release. The sludge remaining in the column after the study period contained 2.3% solids. (Cassar-FRC)
W83-00679

SEWAGE PLUME IN A SAND AND GRAVEL AQUIFER, CAPE COD, MASSACHUSETTS,
Geological Survey, Boston, MA. Water Resources Div.
For primary bibliographic entry see Field 5B.
W83-00688

REGIONAL GEOHYDROLOGY OF THE NORTHERN LOUISIAN SALT-DOME BASIN, PART I, CONCEPTUAL MODEL AND DATA NEEDS,
Geological Survey, Baton Rouge, LA. Water Resources Div.
For primary bibliographic entry see Field 2F.
W83-00691

5F. Water Treatment and Quality Alteration

NEW DEQ WATER POLICY MORE RECEPTIVE TO CITY NEEDS,
League of Iowa Municipalities, Des Moines.
L. W. Elliott.
Current Municipal Problems, Vol 7, No 2, p 240-243, 1980.

Descriptors: *Metropolitan water management, *Water policy, Water management, Planning, Water demand, Public policy, *Iowa, State jurisdiction, Legal aspects, Urban areas, *Water quality standards.

In an effort to more realistically deal with compliance problems facing many Iowa cities, the Department of Environmental Quality's (DEQ) Water Quality Commission recently approved a policy that will use executive order procedures as outlined in the Iowa Code. The policy calls for the use of both compliance letters and executive order. Compliance letters will be used for two purposes. First, in cases where a city's water supply does not meet standards for one or more contaminants, but the health hazard is minimal, the city will receive a compliance letter. In some cases a continuation of monitoring and public notification will be recom-

mended. The second purpose for a compliance letter would be in cases where DEQ needs more data to confirm a suspected violation that must eventually be corrected, suchas a city having high radium levels showing up in the water samples. Once a problem has been documented, DEQ will issue an executive order outlining what violation has occurred and how the city must proceed. Neither a compliance letter nor an executive order will take effect until at least 30 days after the city receives it. (Baker-FRC)
W83-00423

DAILY INTAKE OF LEAD, CADMIUM, COPPER, AND ZINC FROM DRINKING WATER: THE SEATTLE STUDY OF TRACE METAL EXPOSURE,
National Heart, Lung, and Blood Inst., Bethesda, MD. Epidemiology and Biometry Program.
For primary bibliographic entry see Field 5B.
W83-00431

COMPONENTS OF VARIATION IN LEAD, CADMIUM, COPPER, AND ZINC CONCENTRATION IN HOME DRINKING WATER: THE SEATTLE STUDY OF TRACE METAL EXPOSURE,
National Heart, Lung, and Blood Inst., Bethesda, MD. Epidemiology and Biometry Program.
For primary bibliographic entry see Field 5A.
W83-00432

DESTRUCTION OF POLLUTANTS IN WATER WITH OZONE IN COMBINATION WITH ULTRAVIOLET RADIATION. 2. NATURAL TRIHALOMETHANE PRECURSORS,
North Texas State Univ., Denton. Dept. of Chemistry.
W. H. Glaze, G. R. Peyton, S. Lin, R. Y. Huang, and J. L. Burleson.
Environmental Science and Technology, Vol 16, No 8, p 454-458, August, 1982. 9 Fig, 25 Ref.

Descriptors: *Ozonation, *Ultraviolet radiation, *Chlorinated hydrocarbons, *Water treatment, Ozone, Organic compounds, Kinetics, Activated carbon, Mass transfer, *Trihalomethanes, Caddo Lake, *Texas-Louisiana, Cross Lake, *Louisiana, *Oxidation.

Ozone-ultraviolet (03-UV) oxidation was more effective than ozone in destruction of trihalomethane (THM) precursors in water from Caddo Lake, Texas-Louisiana, and Cross Lake, Louisiana. Water from both lakes is characterized by low alkalinity and high levels of dissolved organic matter. Kinetic data suggested that secondary precursors of greater refractivity (probably 2 and 3 carbon polyfunctional organic acids) were formed by oxidation of the original organic compounds. These were resistant to oxidation with ozone alone but were more readily destroyed with the 03-UV process. For communities using water with high THM precursor levels, 03-UV is a viable treatment process either in place of or combined with activated carbon. (Cassar-FRC)
W83-00445

DESTRUCTION OF POLLUTANTS IN WATER WITH OZONE IN COMBINATION WITH ULTRAVIOLET RADIATION. 1. GENERAL PRINCIPLES AND OXIDATION OF TETRACHLOROETHYLENE,
North Texas State Univ., Denton. Dept. of Chemistry.
G. R. Peyton, F. Y. Huang, J. L. Burleson, and W. H. Glaze.
Environmental Science and Technology, Vol 16, No 8, p 448-453, August, 1982. 7 Fig, 4 Tab, 30 Ref.

Descriptors: *Chlorinated hydrocarbons, *Ozone, *Ultraviolet radiation, *Tetrachloroethylene, Organic compounds, *Oxidation, Ozonation, Water treatment, Kinetics, Photolysis, Mass transfer, Hydrocarbons.

A laboratory scale investigation of the ozone-ultraviolet (03-UV) process for oxidation of organic micropollutants in water studied ozone mass transfer, the kinetics of the 03-UV process, and the behavior of a typical substrate, tetrachloroethylene (TCE). The rate of substrate decay was represented as a linear combination of terms from the 4 contributing processes: purging, photolysis, ozonation, and photolytic oxidation (03-UV). Photo lytic oxidation of TCE was generally first-order. Using a continuously sparged stirred tank reactor, the times for elimination of 63% of the TCE substrate (initial concentration, 100 micrograms per liter) were determined for radiation doses of 0 to 0.375 W/L and ozone transfer rates of 0 to 0.78 mg per liter in both purified water and lake water. The 63% elimination times in purified water were 81 min for no radiation and no ozone (nitrogen purging), 4.4 min for the highest radiation dose and no ozone, 12.5 min for no radiation and the highest ozone rate, and 0.47 min for the highest radiation and highest ozone doses. Comparable values for lake water were 100, 20, 26, and 7 min, respectively. In the 03-UV process, elimination of 95% of TCE was 53 min at pH 4 and 395 min at pH 10. (Cassar-FRC)
W83-00446

INFLUENCE OF BROMIDE AND AMMONIA UPON THE FORMATION OF TRIHALOMETHANES UNDER WATER-TREATMENT CONDITIONS,
Imperial College of Science and Technology, London (England).
T. V. Luong, C. J. Peters, and R. Perry.
Environmental Science and Technology, Vol 16, No 8, p 473-479, August, 1982. 5 Fig, 4 Tab, 11 Ref.

Descriptors: *Chlorination, *Trihalomethanes, *Water treatment, *Chlorinated hydrocarbons, Organic matter, Fate of pollutants, Chemical reactions, Bromides, Ammonia.

The effects of low levels of bromide and ammonia on trihalomethane (THM) formation during water chlorination were studied. Chlorine doses were 2 and 8 mg per liter; total organic carbon (TOC) levels, 2.5 and 12.7 mg per liter; and bromide additions, 0-2000 micrograms per liter. THM distribution was dependent on the bromide concentrations at both high and low TOC levels. As bromide concentration increased, chloroform yield decreased, and bromoform concentration increased. At low TOC and high Br levels, bromoform was the major species present, accounting for 75% of the overall THM yield. Changing the Cl dose did not change the THM distribution. At the higher TOC level THM distribution was shifted toward the more chlorinated compounds, except when Cl dose was limiting. The minimum concentration of total THM was achieved at maximum pH and Br concentrations. Changes in pH during treatment had little effect on dissolved brominated THM because the dissolved component was over 90% of the total brominated THM present. The addition of 0.5 mg per liter ammonia to systems with 500 micrograms per liter Br reduced THM production by 30% for conventional breakpoint and by 50% for stepwise breakpoint chlorination. Overall THM yields for chloramination reactions were 38-46 micrograms per mg, compared with 63 micrograms per mg for ammonia-free reactions. (Cassar-FRC)
W83-00447

EVALUATING THE POTENTIAL FOR CONTAMINATING DRINKING WATER FROM THE CORROSION OF TIN-ANTIMONY SOLDER,
Herrera Environmental Consultants, Seattle, WA.
For primary bibliographic entry see Field 5B.
W83-00452

DETERMINING FREE AVAILABLE CHLORINE BY DPD-COLORIMETRIC, DPD-STEADIFAC (COLORIMETRIC), AND FACTS PROCEDURES,
Florida International Univ., Miami.
For primary bibliographic entry see Field 5A.
W83-00453

DISINFECTION.
Journal of the American Water Works Association, Vol 74, No 7, p 10, 376-380, July, 1982. 41 Ref.

Descriptors: *Disinfection, *Drinking water, *Public health, Chlorine, Ozone, Chloramines, Coliforms, Bacteria, Reviews, Potable water, Water treatment, Water quality.

The epidemiological rationale for disinfection is reviewed, along with a discussion of the significance of indicator organisms, and the use of ozone, chlorine, chloramines, and chlorine dioxide together with their toxicological impact on a finished water. The use of a disinfection process can accomplish the goal of a pathogen-free water supply more effectively than any other water treatment process. Most of the controversy centers around the selection of the optimum disinfection process and the requisite monitoring techniques. Much emphasis is currently being placed on the elimination of halogenated organic including trihalomethanes from potable waters. While chlorine will probably remain the treatment of choice for the near future, its use in many treatment facilities will be subject to change regarding dosages, points of application or monitoring requirements. Ozone and chlorine dioxide have distinct advantages for certain treatment applications. Chloramines historically have been important as disinfectants in many water utilities, and widespread use of these chemicals will continue. While the coliform test has served the industry well for many years, there is increasing evidence that coliforms are less resistant to chemical disinfectants than other pathogens. (Baker-FRC)
W83-00466

WATER ENGINEERING RESEARCH AT SWINDON.
Water Services, Vol 86, No 1036, p 284-286, June, 1982.

Descriptors: *Research priorities, *Laboratories, Swindon, *England, Water mains, Underground structures, Rehabilitation, Control systems, Automation, Water treatment, Wastewater treatment.

Swindon is the site of the Water Research Center's latest research facility, where investigations on underground engineering and instrumentation control and automation are conducted. The center contains laboratories and a computer room linked to the other research centers at Stevenage and Medmenham. Among the projects under study are cleaning and rehabilitation of water mains, leakage detection and control, sewer inspection and renovation, materials engineering, and instrumentation control and automation. (Cassar-FRC)
W83-00469

SWIMMING POOL WATER TREATMENT IN THE UK,
Department of the Environment, London (England), Water Research Directorate.
O. D. Hydes, and I. C. Warren.
Water Services, Vol 86, No 1036, p 265-266, June, 1982. 1 Tab, 17 Ref.

Descriptors: *Disinfection, *Chlorination, *Swimming pools, Reviews, *Water treatment, Hypochlorites, Bromine, Ozone, *United Kingdom.

Publications on swimming pool water treatment in the United Kingdom are reviewed. The Department of Environment recommended that use of Cl gas for this purpose should cease by January 1985 and that alternative disinfectants should be substituted. A table lists disinfectants and recommended residuals, pH, and dosage and control methods. The disinfectants listed are sodium hypochlorite, calcium hypochlorite, electrolytically generated hypochlorite, bromine, 1,3-bromochloro-5,5-dimethylhydantoin, sodium dichloroisocyanurate, trichloroisocyanuric acid, and ozone with residual chlorination. (Cassar-FRC)
W83-00470

DISINFECTION,

Illinois Inst. of Tech., Chicago. Pritzker Dept. of Environmental Engineering.
C. N. Haas, and J. J. McCreary.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 54, No 6, p 646-654, June, 1982. 136 Ref.

Descriptors: *Disinfection, *Chlorination, *Water treatment, *Literature review, Chlorine, Residual chlorine, Halogens, Ozone, *Wastewater treatment, Potable water, Inorganic compounds, Organic compounds, Trihalomethanes chemical reactions, Seawater.

Publications concerning five major aspects of disinfection are reviewed. Works on microbiology covered the chlorination of potable water and wastewater with regard to optimization, mixing, and dosage; the interrelationship between chemical measurements of chlorine and biological responses; a mathematical model for wastewater chlorination; the dechlorination of wastewater; the use of ozone, chlorine dioxide, bromine chloride, ultraviolet radiation, silver, and a solid resin with quaternary amine functional groups as disinfectants; and side-by-side comparisons of alternative disinfectants. The second category of publications concerned analytical methods, including procedures for determining free chlorine, residual chlorine in sea water, residual ozone in water, excess NC13, chlorine dioxide in water, and chlorite ion. Studies of inorganic transformations included the persistence or rate of disappearance of chlorine residuals, the reactions of chlorine with sea water, and methods for generating chlorine dioxide. The formation of nonvolatile organic compounds was investigated in spent chlorination liquor from the bleaching of kraft pulp; the phenomenon of chlorination which significantly modified the distribution of polynuclear aromatic hydrocarbon; analysis of products of C102 reactions with 22 volatile compounds; and the use of group parameters to characterize organochlorine compounds. Works concerning the formation of trihalomethanes were also included. (Gish-FRC)
W83-00487

EPA AND WATER SUPPLY--PRESENT AND FUTURE,
Environmental Protection Agency, Boston, MA.
For primary bibliographic entry see Field 5G.
W83-00493

EMERGENCY RESPONSE: A CASE FOR RISK DETERMINATION,
Maine Dept. of Human Service, Augusta.
W. C. Toppan.
Journal of the New England Water Works Association, Vol 96, No 2, p 151-160, 1982. 2 Fig.

Descriptors: *Risks, *Safety, *Toxicity, Emergencies, Carcinogens, Water supply, Maine, Organic compounds, Water pollution effects, Dose response curves.

A history is presented of Maine's Drinking Water Program and risk determination in emergency response planning. The acceptable daily intake (ADI) approach is a value reflecting a combination of knowledge and uncertainty about the relative safety of a chemical. It is a daily dose which is not likely to produce a toxic response in man. However, statistically valid conclusions are not easy to obtain because of the small size of studies and the uncertainty in extrapolating from animals to humans and from high doses to low doses. The risk estimate approach produces an acceptable level of exposure to a chemical. It is based on extrapolation of experimental dose-effect curves to lower dose levels, for which no data exists. The Suggested No Adverse Response Level (SNARL) method was developed for use in water supply. This is a formula considering the observed effect level (obtained from laboratory studies), factors relating laboratory animals to humans and children to adults, absorption factors, and an uncertainty factor. Recent publications have stated that animal toxicity test results may be extrapolated to man, that there is no threshold dose for long-term exposure, that no safe dose exists, that every dose has some risk, and that the most probable risk of a chemical can be estimated by comparing the benefits and risks. (Cassar-FRC)
W83-00494

MAINS INFESTATION CONTROL USING PERMETHRIN,
Severn-Trent Water Authority (England).
R. F. Crowther, and P. B. Smith.
Journal of the Institution of Water Engineers and Scientists, Vol 36, No 3, p 205-213, May, 1982. 1 Fig, 6 Tab, 1 Ref.

Descriptors: *Water distribution, *Aquatic animals, *Insecticides, Water treatment, Water mains, Asellus, Gammarus, *Permethrin, Isopods, Amphipods, Invertebrates.

An extensive infestation of Asellus and Gammarus in the water distribution system of the city of Derby, England, was controlled by flushing the system with 2% permethrin solution in April 1980. The treatment involved dechlorination of the system with sodium thiosulfate followed by two 7-day periods of permethrin injection. Water samples taken at the sewage works 4 days after the start of dosing showed no detectable permethrin. No effects on digester performance were seen. Mean levels of permethrin (micrograms per liter) in the system were: initial, 11.4; during dosing, 5.3; 2 days after dosing, 5.6; 3 days after dosing, 0.37, and 39 days after dosing, < 0.01. The fauna were absent from water samples taken several months later in September (except for one of 8 sections of the system). (Cassar-FRC)
W83-00498

DESIGN AND CONSTRUCTION OF THE PENNICHUCK WATER TREATMENT PLANT: THE EQUIPMENT SUPPLIER'S VIEW,
Infilco Degremont Inc., Richmond, VA.
C. H. Thorborg.
Journal of the New England Water Works Association, Vol 96, No 2, p 88-96, 1982. 6 Fig.

Descriptors: *Clarifiers, *Filtration, *Water treatment facilities, Water treatment, Pulsator clarifier, Pennichuck Water Works, Nashua, New Hampshire, Turbidity.

Equipment for the Pennichuck Water Works was chosen to handle the characteristics of the raw water, which were soft, low in total dissolved solids and alkalinity, 1-5 NTU turbidity, 20-30 color units, cold winter water temperatures, and significant organic content. The treatment included clarification with chemical addition and filtration, followed by chlorination. The Pulsator, an upflow sludge blanket clarifier, was the choice for the clarification step. Its basic parts were: vacuum chamber, vacuum blower (the mechanical heart), raw water distribution, treated water collection, sludge hoppers, and tank. Design flow is 20 mgd (using two 10 mgd Pulsators) with a hydraulic limit of 30 mgd. Six double bay Aquazur filters with a common clarified water/filter feed channel and a 1 million gal treated water clear well complete the basic design. Chemical feed and control are automated. (Cassar-FRC)
W83-00501

DESIGN AND CONSTRUCTION OF THE PENNICHUCK WATER TREATMENT PLANT: THE OWNER'S VIEW,
Pennichuck Water Works, Nashua, NH.
J. C. Collins.
Journal of the New England Water Works Association, Vol 96, No 2, p 84-87, 1982.

Descriptors: *Construction, *Planning, *Water treatment facilities, Financing, Pennichuck Water Works, Nashua, *New Hampshire, Design criteria, Water treatment, Economic aspects.

Initial planning for the 20 mgd Pennichuck Water Works, Nashua, New Hampshire, began in 1974, spurred by the gradual deterioration of the raw water supply and population growth. In spite of delays and the necessity to double the rate base of $7 million, the plant went on-line July 31, 1980, 5 months ahead of schedule and $400,000 below contract construction costs. The success of the project was attributed to good planning, flexibility in management, good construction planning and management, and effective team work. Financing for this investor-owned company was through municipal industrial revenue bonds, a preferred stock offering, a $7 million unsecured construction loan, and a rate increase. (Cassar-FRC)
W83-00502

COLOUR AND TURBIDITY REMOVAL WITH REUSABLE MAGNETIC PARTICLES-III IMMOBILIZED METAL HYDROXIDE GELS,
Commonwealth Scientific and Industrial Research Organization, Melbourne (Australia).
N. J. Anderson, L. O. Kolarik, E. A. Swinton, and D. E. Weiss.
Water Research, Vol 16, No 8, p 1327-1334, August, 1982. 7 Fig, 11 Ref.

Descriptors: *Turbidity, *Water treatment, *Clarification, Color removal, Water quality, Coagulation, Chemical coagulation, Adsorbents.

The preparation and use of a magnetic coagulant-adsorbent for removing color and turbidity from surface water is described. The adsorbent was made by deposition of ferric hydroxide gel onto fine magnetite. The surface charge of such a composite particle is pH dependent, and the amphoteric properties of the ferric hydroxide gel coating can be exploited in the clarification process. At pH less than 6, the surface is positively charged and adsorption of negatively charged particles occurs. Conversely, the adsorbed impurities can be released by increasing the pH to above pH 10. The reactivated particles can then be reused. The particles have high sedimentation rates and are easy to handle magnetically. The magnetic gel was successfully employed to treat a number of waters. It was especially effective in treating a highly colored reservoir water. It was possible to reuse the gel after regeneration for many cycles with a gradual deterioration in performance. (Baker-FRC)
W83-00506

ORGANIC AND ORGANOTIN COMPOUNDS LEACHED FROM PVC AND CPVC PIPE,
Michigan Univ., Ann Arbor. School of Public Health.
E. A. Boettner, G. L. Ball, Z. Hollingsworth, and R. Aquino.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-108333, Price codes: A06 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S1-81-062, February 1982. 10 p, 2 Fig, 2 Tab.

Descriptors: *Organics solvents, *Organotin compounds, *Plastic pipes, *Leaching, *Water pollution sources, *Polyvinyl chloride, *Chlorinated polyvinyl chloride, Potable water, Sealants, Water supply, Chemical analysis, Tin, Dimethyltin, Dibutyltin, Methyl ethyl ketone, Tetrahydrofuran, Cyclohexanone.

Use of polyvinyl chloride (PVC) and chlorinated polyvinyl chloride (CPVC) pipe for potable water raises the question of whether chemicals of a toxic nature diffuse from the pipe into the water supply, and if so, in what quantities. Commercial pipe samples stabilized with dialkyltin-bis-isooctylthioglycolate compounds were tested for leaching. Alkyltin species were extractable from PVC and CPVC pipes by water. The amount of dimethyltin (as the dichloride) leached from PVC into pH 5 extractant water at 37C was 35 ppb for day one, and decreased from approximately 3.0 to 0.25 ppb in a biphasic manner from days 2 through 22. The amount of dibutyltin (as the dichloride) leached from CPVC into pH 5 extractant water at 72C was 2.6 ppb for day one, and decreased from 1.0 to 0.03 ppb in a biphasic manner from days 2 through 21. Volatile organic solvents (including methyl ethyl ketone, tetrahydrofuran, and cyclohexanone) used in the sealing cements applied to PVC and CPVC pipe joints continued to leach into water supplies for more than 14 days using a miniature pipe system. The quantities ranged from 10 ppm to 10 ppb during the 15 days of sampling. Sufficient

toxicological data are not available to assess the health significance of the very low levels of organotin and cement solvent chemicals found in this study. (Moore-SRC)
W83-00633

MICROBIOLOGY OF POTABLE WATER AND GROUND WATER,
Environmental Protection Agency, Dallas, TX. Region VI.
M. J. Allen.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 54, No 6, p 943-946, June, 1982. 41 Ref.

Descriptors: *Literature reviews, *Microbiological studies, *Reviews, Drinking water, *Potable water, Water treatment, *Groundwater, Bacteria, Wastewater irrigation, Granular activated carbon, Carbon, Activated carbon, Disinfectants, Viruses, Microorganisms, Monitoring wells, Monitoring, Irrigation.

Recent research in the area of microbiology of potable water and groundwater is cited in this literature review. For potable water, increased use of the granular activated carbon and alternate disinfection practices to reduce trihalomethane formation has been studied. Also in the area of potable water, research has centered on heterotrophic bacterial populations that develop on GAC particles, on biocidal efficiencies of alternate drinking water disinfectants, on virus removal efficiencies during water treatment varying with type and dosage of coagulant, on changes in bacterial populations during a 19 month period, on types of particulates that can occur in tap water and stimulate microbial growth, and on viruses contained in municipal wading pools. In the area of groundwater research, the topics have included lysimeters and monitoring wells in areas irrigated with wastewater effluent. (Baker-FRC)
W83-00655

5G. Water Quality Control

PHOSPHORUS REDUCTION IN A MAN-MADE LAKE BY MEANS OF A SMALL RESERVOIR ON THE INFLOW,
Hydraulic Research Inst., Prague (Czechoslovakia).
L. Fiala, and P. Vasata.
Archiv fur Hydrobiologie, Vol 94, No 1, p 24-37, April, 1982. 8 Fig, 3 Tab, 11 Ref.

Descriptors: *Nutrient removal, *Phytoplankton, *Bacteria, Reservoirs, Jesenice Reservoir, *Czechoslovakia, Phosphorus, Nitrogen, Water quality control.

Phosphorus and nitrogen were reduced in a pre-reservoir formed by a railway embankment crossing the Jesenice Reservoir, Czechoslovakia. Inflowing water contained 400-600 micrograms per liter inorganic P, 500-800 micrograms per liter total P, and 5.5 mg per liter total N. Nutrient reductions at 5 or more days retention periods in summer were 90%, 65-70%, and 30-40%, respectively. Coliform bacteria were reduced from 100,000 per ml to about 1000 per ml. During summer stagnation phytoplankton blooms were seen in the pre-reservoir but not in the main body. Factors other than phytoplankton contributing to elimination of nutrients were probably chemical precipitation or sorption of P with Fe in the water and sediments. (Cassar-FRC)
W83-00396

URBAN RUNOFF CONTROL TECHNOLOGY,
Ontario Ministry of the Environment, Toronto.
For primary bibliographic entry see Field 5D.
W83-00416

ADJUDICATORY HEARINGS AS PART OF THE NPDES HEARING PROCESS,
Washington Univ., Seattle. Dept. of Civil Engineering.
For primary bibliographic entry see Field 6E.
W83-00424

EFFECT OF INDUSTRIAL-RESIDENTIAL ZONES ON WATER QUALITY OF SURFACE STREAMS,
For primary bibliographic entry see Field 5B.
W83-00460

EPA AND WATER SUPPLY--PRESENT AND FUTURE,
Environmental Protection Agency, Boston, MA.
L. A. Sutton.
Journal of the New England Water Works Association, Vol 96, No 2, p 135-139, 1982.

Descriptors: *Water supply, *Groundwater pollution, *Drinking water, *New England, Regulations, Water pollution sources, Public health.

New priorities of the EPA are described. These include a leaner budget, reorganization and streamlining, delegation of some responsibilities to the states, regulatory reform, improvement of the scientific base, placing environmental problems in a proper perspective, and improved public relations. The chief priority in the water supply program is provision of safe drinking water by using highest quality water sources and protecting these sources from degradation. Most New England surface water sources are relatively free of pollution by municipal and industrial wastewater discharges. Some threats to groundwater are storm water runoff (especially from road deicing salt), septic tank, leaching, leaking underground gasoline tanks, and illegal hazardous waste disposal. (Cassar-FRC)
W83-00493

THE USE OF HERBICIDES FOR AQUATIC WEED CONTROL IN WATER SUPPLY CATCHMENTS,
Severn-Trent Water Authority (England).
For primary bibliographic entry see Field 3B.
W83-00496

NATIONAL DRINKING WATER ADVISORY COUNCIL AND WATER UTILITY COUNCIL: WHAT DO THEY DO.,
Manchester Water Works, NH.
F. H. Elwell.
Journal of the New England Water Works Association, Vol 96, No 2, p 146-150, 1982.

Descriptors: *Legislation, *Water supply, *Utilities, Organizations, Regulations, Drinking water, Planning, National Drinking Water Advisory Council, Water Utility Council, Safe Drinking Water Act, American Water Works Association.

The National Drinking Water Advisory Council (NDWAC) and the Water Utility Council (WUC) have been established within the past ten years to advise on matters involving the provision of safe drinking water. The NDWAC consists of 15 members, 5 from each of the following: general public, state and local agencies concerned with public water supply, and private groups actively interested in public water supply. On the agenda are volatile organics and development of groundwater protection strategy. The WUC, the utility voice of the American Water Works Association, is concerned with legislation and regulatory matters affecting water utilities. The 20 WUC members form 4 permanent sub-committees: Small Water Systems, Large Water Systems, Regulatory Reform, and Legislation. A major item facing the Council is amendment of the Safe Drinking Water Act. The importance of communication with legislators by all those involved in water utilities is emphasized. (Cassar-FRC)
W83-00503

LIMNOLOGICAL RESEARCH CAN IMPROVE AND REDUCE THE COST OF MONITORING AND CONTROL OF WATER QUALITY,
Uppsala Univ. (Sweden). Inst. of Limnology.
C. Forsberg.
Hydrobiologia, Vol 86, No 1/2, p 143-146, January, 1982. 21 Ref.

Descriptors: *Sampling, *Monitoring, *Lake management, *Sweden, Water quality management, Pollutant identification, Limnology, Research priorities, Lakes, Rivers, Planning, Phosphorus, Water pollution effects.

Shortcomings in water quality control and monitoring programs in Sweden include: no central guidelines; great variations in sampling, analysis, and reporting techniques; no defined objectives; low-frequency sampling; limited flow data in running water studies; reporting of untreated primary data; and lack of studies to detect long-term changes. More reliable information at greater cost efficiency may be obtained by higher frequency sampling, especially in shallow lakes and small rivers; analysis of composite samples from strategically chosen stations; correlation analysis (for example, between summer average values and summer maximum values) to predict worst possible situations; and consideration of lake responses to nutrient loading. Further improvements can be realized with better information on relationships between structure and function of aquatic ecosystems and parameters such as form and size of water body, water flushing rate, and pollutant loads. (Cassar-FRC)
W83-00526

THE LIMNOLOGICAL BASIS FOR PLANNING WATER QUALITY MANAGEMENT,
Lund Univ. (Sweden). Limnological Inst.
I. Lundqvist.
Hydrobiologia, Vol 86, No 1/2, p 147-151, January, 1982. 3 Fig, 7 Ref.

Descriptors: Control, Recreation, *Sweden, Lakes, Limnology.

Planning for water conservancy (quality), water restoration, and water quality management must be based on an ecological approach. The ecological rules which consider both cultural and scientific nature conservancy planning should protect representative and unique water resources, water resources important to discrete species, water resources with esthetic values, and water resources of scientific importance. Guidelines for the restoration of damaged ecosystems should include assessment of the needs and conditions for restoration measures, considering the value of the lake to be restored and the needs for restoration work. A model for making water quality management decisions is presented. It consists of several stages: 1, integration of existing data; 2, identification of problems; 3, conflict analysis; 4, planning documents (identification of problems, problem solution, and consequence analysis); 5, decision making; 6, master plan; 7, implementation; and 8, post analysis. Examples of planning for water conservancy and lake restoration are given for several Swedish lakes. (Cassar-FRC)
W83-00527

WINTER MICROBIAL ACTIVITY IN LAKE TUUSULANJARVI,
Helsinki Water District (Finland).
T. Tamminen.
Hydrobiologia, Vol 86, No 1/2, p 109-113, January, 1982. 4 Fig, 2 Tab, 13 Ref.

Descriptors: *Heterotrophic bacteria, *Aeration, *Lake restoration, Eutrophic lakes, Lakes, Lake Tuusulanjarvi, *Finland, Primary productivity, Productivity, Dissolved oxygen, Oxygen, Seasonal variation, Nitrogen, Phosphorus, Fate of pollutants, Water pollution effects.

Microbial heterotrophic activity, dark carbon dioxide assimilation, primary productivity, and microbial ATP were determined from July 1979 to May 1979 in Lake Tuusulanjarvi, an extremely eutrophied lake. Pollution from the town of Jarvenpaa was ended in March 1979 after several decades of input. Nonpoint source pollution was also heavy. Aeration of the lake began in early autumn. This circulation prevented winter stratification. Nutrient concentrations were 1100-2300 micrograms per liter total N and 45-140 micrograms per liter total P. Glucose turnover times were 5-7 hours in summer, 10-20 hours from August to January (and in April) and 100-110 hours in February-March. Temperatures were about 1C from November to

April. Oxygen saturation reached a minimum of 46% compared with less than 25% during previous years when aeration was also carried out. Primary productivity was 10,000 mg C per sq m per day in summer, declining to 5000 mg C per sq m per day in November, and was measurable during the ten winter months. Dark C02 assimilation increased to 14% of primary productivity in March. (Cassar-FRC)
W83-00528

OIL SPILL CLEANUP FULFILLS AIM OF FEDERAL WATER POLLUTION CONTROL ACT,
M. Silver.
Natural Resources Journal, Vol 22, No 2, p 489-491, April, 1982. 12 Ref.

Descriptors: *Cleanup, *Legal aspects, *Oil spills, Cleanup operations, Water pollution control, Water pollution sources, Vandalism, Water quality standards.

On April 3, 1975 unknown vandals entered the yard of the Union Petroleum Corporation and discharged oil from two tank cars owned by and leased to third parties. Although seals were attached to valves on the tank cars loaded with oil, these valves were not locked and were susceptible to vandalism. The discharge amounted to about 600,000 gallons of fuel oil. Union promptly notified the Coast Guard, a cleanup contractor, the local police and fire departments and the state authorities. Union paid $99,952.17 in cleanup costs. In a subsequent suit the decision was made that those in charge of oil terminals who have taken reasonable precautions to prevent vandalism and oil spills into navigable rivers will be reimbursed when vandals spill oil from tank cars parked at the terminal. By awarding Union the full $99,952.17 encourages other terminal operators to quickly cleanup harmful discharges into the nation's waters. The court implicitly recognized that the general security practice in the industry is a reasonable standard of care. Though the standard tolerates some danger of discharge of harmful substances, this level of industry risk remains unchanged by the decision of the Court of Claims. (Baker-FRC)
W83-00566

NATIONAL ACID PRECIPITATION ASSESSMENT PLAN.
Report, Interagency Task Force on Acid Precipitation, 722 Jackson Place, N.W., Washington, D.C., 20006, June 1982. 92 p, 7 Fig, 1 Tab, 28 Ref. 3 Append.

Descriptors: *Research priorities, *Acid rain, *Air pollution, *Project planning, *Interagency cooperation, Rainfall, Fallout, Acidic water, Chemistry of precipitation, Legal aspects, Constitutional law, Optimum development plans, Alternative planning, Multiobjective planning, Management planning, Governmental interrelations.

The Acid Precipitation Act of 1980 established the Interagency Task Force on Acid Precipitation to develop and implement a comprehensive National Acid Precipitation Program. The developed plan for this program has five parts: a description of the authorizing legislation, the plan organization, and past and current acid rain research; a general overview of current understanding of the phenomena and consequences of acid rain; a discussion of information needed to enhance understanding of these phenomena and consequences; a description of proposed research to address the information needed; and a discussion of the general strategy for management and coordination of the overall program. Research is proposed in nine basic categories where more information concerning acid precipitation is needed. The described research tasks each focus on a specific area and generally involve the coordinated participation of several agencies and are categorized according to one of three priority levels. The Interagency Task Force is jointly chaired by the Department of Agriculture, EPA, and NOAA. Other participating agencies are: the Departments of Interior, Health and Human Services, Commerce, Energy, State; NASA; the Council of Environmental Quality; the National Science Foundation; and the Tennessee Valley Authority. (Zielinski-MAXIMA)
W83-00607

STEADY-STATE ECOSYSTEM MODELING FOR LAKE MANAGEMENT,
Maine Univ. at Orono. Land and Water Resources Center.
M. L. Hutchins, and P. D. Uttormark.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-125153, Price codes: A04 in paper copy, A01 in microfiche. Completion Report, July, 1982. 64 p, 13 Fig, 2 Tab, 46 Ref, 1 Append. OWRT B-018-ME(2).

Descriptors: *Ecosystems, *Model studies, *Long-tern planning, *Lake morphology, *Water management, Ecology, Mathematical models, Mathematical studies, Computer models, Fish populations, Plant populations, Algal growth, Algal control, Biomass, Aquatic productivity, Fish, Lake classification, Eutrophic lakes, Maine.

Two relatively simple models which appear useful for describing general ecosystem structure and interactions in the open-water zones of lakes are presented. These models are concerned with long-term steady-state conditions, rather than seasonal dynamics, and are used to examine how steady-state standing crops of the system components might be expected to change in response to a variety of system perturbations. Manipulative options showing potential for curbing undesirable eutrophication symptoms are particularly identified. The results indicate that lake ecosystem response to system partubations may be highly dependent on system structure. Minor system component/interaction changes may produce drastic system dynamics changes. It is shown that enhancing lake game fish populations may produce positive/negative effects on algal populations, depending on system structure/interactions, Further, two distinctly different steady-state lake ecosystems were found possible for a given nutrient supply rate. A predator-dominated system is viewed desirable, with low algal and high game fish biomasses even under phosphorus-rich conditions. A nutrient-limited system is less desirable, with high algal and low game fish biomasses. The ecological significance of two equilibria states is elaborated. (Zielinski-MAXIMA)
W83-00610

WAYBILL SYSTEM IS A KEY TO INDUSTRIAL WASTE MANAGEMENT AND DISPOSAL,
S. Davey.
Water and Pollution Control, Vol 120, No 4, p 19-20, July/August, 1982.

Descriptors: *Wastewater disposal, *Wastewater managment, *Industrial wastewater, *Water quality control, Industrial wastes, Wastewater treatment, Municipal wastewater, Liquid wastes, Waste management, Waste disposal, *Ontario, Niagara River.

There are 19 municipal and industrial sources of wastewater discharge into the Niagara River that meet Ontario standards or are currently under programs designed to meet these standards for river water quality control. However, problems of waste disposal on this river and in Lake Ontario into which it discharges are apparent in major pollution episodes at Love Canal and Hyde Park. The public expects government and industry to safeguard public health by disposing of harmful wastes in a proper manner. The Waybill system helps to meet these expectations by controlling the handling of liquid industrial wastes. New data processing and telecommunication systems will make waste handling and disposal records more accessible to regional enforcement agents. A special investigation unit of Environment Ontario has conducted 213 probes which resulted in 71 convictions in the past year. Waste management has been set as a priority program of the Environment Ontario Ministry. The Ontario Waste Management Corporation was established as a crown agency and plans three major technical projects. The first is an in-depth assessment of liquid industrial waste sources. The second deals with the various treatment and disposal techniques available. The third investigates possible sites for facilities while taking into account various social and environmental factors. The Corporation will also conduct a province-wide information program to keep the public informed of its works. (Geiger-FRC)
W83-00611

SURVEY OF ON-GOING AND COMPLETED REMEDIAL ACTION PROJECTS,
SCS Engineers, Covington, KY.
N. Neely, D. Gillespie, F. Schauf, and J. Walsh.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-134115, Price codes: A11 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S2-81-246, January 1982. 4 p, 3 Tab. 68-01-4885.

Descriptors: *Hazardous materials, *Waste disposal, *Water pollution sources, *Groundwater pollution, *Water pollution control, Injection wells, Underground waste disposal, Land disposal, Waste dumps, Landfills, Incineration, Surface water.

During the summer of 1980, a nationwide survey was conducted to determine the status of remedial measures applied at uncontrolled hazardous waste disposal sites. Over 130 individuals were contacted to obtain information on remedial action projects. A total of 169 sites were subsequently identified as having had some kind of corrective measures. Remedial actions had been implemented at many kinds of hazardous waste disposal facilities including drum storage areas, incinerators, and injection wells, but most frequently at landfills/dumps and surface impoundments. At the sites receiving such remedial actions, groundwater was the most commonly affected media, followed closely by surface water. Although several types of technologies were identified, remedial activities usually consisted of containment and/or removal of the wastes. Sufficient money was often not available for complete environmental cleanup (e.g., groundwater extraction and treatment). A lack of sufficient funds and/or improper selection of corrective technologies were responsible for remedial actions having been applied effectively at only a portion of the uncontrolled hazardous waste disposal sites. Where applied, remedial actions were completely effective only 16% of the time. Nine sites were studied in detail to document typical pollution problems and remedial actions at uncontrolled hazardous waste disposal sites. Of the nine sites, remedial actions were completely effective at two and partially effective at the other seven. Technologies used represented (1) containment, (2) removal of waste for incineration or secure burial, (3) institution of surface water controls, and/or (4) institution of groundwater controls. (Author's abstract)
W83-00637

SORPTION OF ZINC BY LAKE MICHIGAN SEDIMENTS--IMPLICATIONS FOR ZINC WATER QUALITY CRITERIA STANDARDS,
Wisconsin Univ.-Stevens Point. Dept. of Chemistry.
For primary bibliographic entry see Field 5B.
W83-00643

POWER INDUSTRY WASTES,
Tennessee Valley Authority, Chattanooga.
T.-Y. J. Chu, and H. Olem.
Journal of the Water Pollution Control Federation (Literature Review Issue), Vol 54, No 6, p 990-1002, June, 1982. 2 Tab, 217 Ref.

Descriptors: *Literature reviews, *Powerplants, *Reviews, Nuclear powerplants, Thermal powerplants, Hydroelectric plants, Electric powerplants, *Industrial wastes, Regulations, Environmental effects.

Recent research in the field of power industry wastes as it pertains to water resources is cited in this literature review. Environmental regulations recently issued include the regulatory reform efforts of the Reagan Administration, the amendments to the industrial provisions of the Clean Water Act, and the final Phase II technical stand-

ards for the treatment, storage, and disposal of hazardous wastes under the Resource Conservation and Recovery Act. Hydroelectric power plant research centered on environmental assessments and the siting of new plants. Fossil-fueled power plant research also dealt with environmental assessment and plant sites. Waste characterization, treatment, disposal, and utilization considered the areas of ash disposal, cooling system and cooling water discharge, flue gas desulfurization, and miscellaneous wastes. Nuclear power research included the environmental assessment along with waste characterization, treatment and disposal. Fluidized-bed combustion and waste heat utilization were also considered. (Baker-FRC)
W83-00657

COST-EFFECTIVE PROGRAM FOR COMBINED SEWER OVERFLOW ABATEMENT,
O'Brien and Gere Engineers Inc., Syracuse, NY.
R. C. Ganley, G. N. Kirsch, A. J. Oliver, J. M. Karanik, and R. R. Ott.
Journal of the Water Pollution Control Federation, Vol 54, No 8, p 1215-1223, August, 1982. 10 Fig.

Descriptors: *Combined sewer overflows, *Storm-overflow sewers, *Sewer systems, Combined sewers, Overflow, Onondaga County, *New York, Syracuse, Model studies, Storm water, Storm wastewater, Water quality control.

The magnitude of combined sewer overflow (CSO) problems in Onondaga County, New York, was assessed using the SWMM and simplified SWMM models to analyze the interrelationships between dry weather flow, storm patterns, runoff rates, and sewer system constraints. In addition, monitoring at 25 selected overflows confirmed model results and located areas of high pollutant loading. Evaluation of several abatement alternative options produced a comprehensive master plan based on CSO collection and treatment in drainage areas. The plan included installation of 6400 m of CSO transmission pipelines, construction of 6 CSO treatment facilities, and modification of 2 existing demonstration CSO treatment facilities. The modifications, called the best management practices/system improvements program (BMP) included overflow dam modifications, backwater gate installations, regulator pipe capacity increases, interceptor cleaning, relief sewer construction, interceptor rehabilitation, in-line grit chamber construction, and modifications to allow CSO storage in the existing sewer. Simulation of a 90% storm event on the present and proposed systems showed that total overflow volume will be reduced by 31%, total suspended solids and BOD by 28%, volatile suspended solids and total Kjeldahl nitrogen loadings by 31%, total inorganic P by 26% and fecal coliform loading by 33%. (Cassar-FRC)
W83-00659

NONPOINT-SOURCE POLLUTION CONTROL: A RESOURCE CONSERVATION PERSPECTIVE,
Science and Education Administration, Tifton, GA. Southeast Watershed Research Center.
W. G. Knisel, R. A. Leonard, and E. B. Oswald.
Journal of Soil and Water Conservation, Vol 37, No 4, p 196-199, July-August, 1982. 20 Ref.

Descriptors: Water resources development, *Soil conservation, *Erosion control, *Nonpoint pollution sources, Sediment erosion, Water pollution sources, Land management, Conservation, Pesticide drift, Watershed management, Water quality management, Agricultural runoff, Mississippi Delta.

Some aspects of the Federal Water Pollution Control Acts Amendment of 1972 and the Soil and Water Resources Conservation Act of 1977 are in conflict with each other. Management practices are applied on farm fields for resource conservation, while nonpoint-source pollution control is often carried out on a much larger scale at some point in a stream system. Sediment has been identified as the major nonpoint-source pollutant. Erosion may be effectively controlled by conservation tillage, but the added pesticides required increase the chemical pollution of runoff. Grass or alfalfa buffer strips along channels or streams in the palouse of the Pacific Northwest are an effective means of reducing nonpoint pollution. Tillage of plots to reduce pesticide runoff in the Mississippi Delta area results in increased erosion, while overgrazing in the arid regions of the Southwest causes increased erosion and nonpoint source pollution by sediments. Some management practices recommended for soil conservation or improved water quality are discussed. Better criteria are needed for land use planners to determine what measures are required to meet the increasing demands of food production and environmental quality. (Geiger-FRC)
W83-00665

MANAGING WATER QUALITY IN CHANNEL CATFISH PONDS,
Auburn Univ., AL. Dept. of Fisheries and Allied Aquacultures.
C. E. Boyd.
Journal of Soil and Water Conservation, Vol 37, No 4, p 207-209, July-August, 1982. 3 Fig, 1 Tab, 30 Ref.

Descriptors: *Water quality control, *Water pollution effects, *Eutrophication, *Oxygen demand, *Fish farming, *Catfish, Carbon dioxide, Photosynthesis, Respiration, Oxygen depletion, Fishkill, Toxicity, Aeration.

In channel catfish farming ponds, water quality often becomes the limiting factor to catfish production. Feeding rates must be carefully controlled to prevent phytoplankton blooms. Use of simazine for algae control reduced dissolved oxygen (DO) levels for two months after treatment. As feeding rates are increased, a point is reached where photosynthesis does not produce enough oxygen to satisfy nighttime demands. Oxygen dynamics are affected by temperature, respiration rates, and weather conditions. Carbon dioxide can be removed from ponds by hydrated lime, but there is no effective way to reduce ammonia concentrations. Sodium chloride or calcium chloride protects fish against nitrite toxicity. Water quality deterioration increases fish susceptibility to diseases and parasites. Moderate feeding rates of 50 to 70 pounds per acre daily are recommended. Even at these rates, emergency aeration must be used to prevent low oxygen-related fishkills. (Geiger-FRC)
W83-00666

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

ESTIMATION OF SMALL-SCALE HYDROPOWER POTENTIAL,
California Univ., Los Angeles. School of Engineering and Applied Science.
D. A. Poppe, and W. W.-G. Yeh.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 108, No WR1, p 145-151, March, 1982. 1 Fig, 4 Tab, 12 Ref.

Descriptors: *Small watersheds, *Hydroelectric power, Projections, Watershed management, Electric power production, Electric potential, Electric powerplants, Mathematical studies, Statistical methods, Model studies, *California.

Simplified planning techniques are needed to project the installed capacity and energy yield of potential small-scale hydroelectric powerplant sites. A statistical method has been developed which uses generally available watershed characteristics to determine the hydropower potential of watersheds less than 500 square miles in area. Monthly streamflow data for a 20-year period and reservoir characteristic curve data were used to estimate the hydropower potential for each of 30 small watersheds using a sequential period reservoir routing technique. The values of hydropower potential obtained for 27 of the watersheds were used as the dependent variable in the regression equation used in the statistical model. A separate regression equation relating annual yield to watershed characteristics was used to estimate the annual yields of watersheds for which no streamflow records were available. The annual yield and hydropower estimation equations developed were verified using data from the three remaining watersheds. The results showed that the hydropower potential of small California watersheds can be estimated with reasonable accuracy from watershed characteristics using a stepwise multiple regression model. This model can be directly applied in its present form to most watersheds in California, gaged or ungaged, with or without existing structures, at a relatively low cost. (Carroll-FRC)
W83-00357

WATER RESOURCES AND ENVIRONMENTAL PLANNING USING INTERACTIVE GRAPHICS,
Cornell Univ., Ithaca, NY.
D. P. Loucks, P. N. French, and M. R. Taylor.
Water Supply and Management, Vol 6, No 4, p 303-320, 1982. 11 Fig, 15 Ref.

Descriptors: *Computer programs, *Graphical analysis, *Planning, Maps, Model studies, Data processing, Water resources development, Water management, Flood control, Computers, Automation, Mathematical models.

Interactive computer-aided planning (CAP) programs for linking mathematical models for water and related land resource planning with graphic devices are described. These programs, suitable for use with both alphanumeric and graphic display terminals, also help with adaptation, calibration, and application of planning models to site-specific problems and with interaction of groups of models with data bases. Information, such as graphs, maps, or pictures, may be input by solution of models or by using a digitizing pen and tablet or video digitizing camera. These programs may be used to study specific watershed and river basin development issues and as teaching aids for engineering students. Figures illustrate some of the graphics obtained from the program, for example, a map showing the extent of a flood area from different flood control alternatives. Specific uses for the programs include: (1) forecasting and conjunctive control of surface and subsurface water quantity and quality, (2) studying urban hydrology, (3) predicting flooding from large storms or dam failures, (4) studying hydrodynamics and predicting pollutant concentrations in lakes and estuaries, (5) examining water supply demand caused by energy development schemes, and (6) inputting and manipulating 3-dimensional geographic data bases which have many attributes varying over time. (Cassar-FRC)
W83-00456

OPTIMAL PLANNING OF IRRIGATION DISTRIBUTION AND APPLICATION SYSTEMS FOR A LARGE IRRIGATED AREA,
Idaho Univ., Moscow. Coll. of Engineering.
For primary bibliographic entry see Field 3F.
W83-00616

PRACTICAL APPLICATION OF LINEAR PROGRAMMING AND NETWORK FLOWS - PROCEEDINGS OF THE TECHNOLOGY TRANSFER WORKSHOP.
Canada Centre for Inland Waters, Burlington (Ontario).
Technical Workshop Series No 3, Environment Canada, Inland Waters Directorate, Ottawa, 1982. 128 p, 16 Fig, 1 Tab, 13 Ref. 1 Append.

Descriptors: *Linear programming, *Flow nets, *Computer models, *Large watersheds, *Systems engineering, Systems analysis, Networks, Network design, Multireservoir networks, Flow pattern, Flow profiles, Flow system, Flow, Mathematical models, Mathematical studies, Model studies, *Ottawa River basin.

Workshop participants were exposed to current optimization methodology to assist appropriate application of this methodology to water resources

management problems. Special emphasis was placed on the integration of optimization techniques, specifically for network flows (NF) and linear programming (LP) with non-decision-making simulation models for increasing the effectiveness of current mathematical modeling studies. Three documented large-scale models are discussed in detail: the hydro-configuration modeling system (HCMS), used extensively in Ottawa River basin studies; the Ottawa River regulation modeling system (ORRMS), developed to permit integrated operation of Ottawa River basin reservoirs; and the Great Lakes SYSNET model, a specially-designed optimal solution-seeking simulation model for regulating the entire Great Lakes system. The workshop sought to transfer knowledge and experience to systems/engineering/management/scientific personnel in the successful operation of linear LP and NF, to correct misconceptions concerning systems engineering techniques (e.g., LP and NF), and to identify priorities for further applications of systems engineering techniques as related to management of large water systems. (Zielinski-MAXIMA)
W83-00628

6B. Evaluation Process

DECENTRALIZING WATER RESOURCE PLANNING AND MANAGEMENT,
Prince (Malcolm), Inc., Buffalo, NY.
W. C. Wright, R. Cohen, and J. H. Heath.
Journal of the American Water Works Association, Vol 74, No 7, p 6, 334-345, July, 1982. 5 Fig, 2 Tab, 37 Ref.

Descriptors: Vermont, Virginia, West Virginia.

Successful water planning in eastern states depends not only on recognition of the need for good planning but also on public participation and each state's legislative support and funding to implement plans. Examples of efforts to develop state water plans in eastern states are discussed and compared. The history of water resource development is reviewed, and results of a survey are presented which encompassed 21 eastern states regarding what their efforts and problems associated with water resource affairs had been in the past. A methodology is outlined for states to consider in developing water allocation strategies and a resource planning program. A tabular presentation of water resources planning and management practices for eastern states identifies the lead state planning or coordinating agency or office, the interstate regional planning committee, the Title II interstate river basin commission, the federal interstate water compacts or commissions, and the applicable statute law mandating water resources planning. (Baker-FRC)
W83-00454

DEVELOPMENT PROCESS FOR IMPROVING IRRIGATION WATER MANAGEMENT,
Colorado State Univ., Fort Collins. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 3F.
W83-00458

GROUNDWATER SUPPLY EXPLORATION IN SEMI-ARID REGIONS FOR LIVESTOCK EXTENSION--A TECHNICAL AND ECONOMIC APPRAISAL,
Wellfield Consulting Services, Baborone (Botswana).
J. L. Farr, P. R. Spray, and S. S. D. Foster.
Water Supply and Management, Vol 6, No 4, p 343-353, 1982. 4 Fig, 2 Tab, 6 Ref.

Descriptors: *Groundwater availability, *Economic aspects, *Exploration, *Water supply development, Benefits, Cost-benefit analysis, *Botswana, Livestock, Semiarid lands, Geohydrology, Drilling, Boreholes, Well development, Wells.

The technical feasibility and cost effectiveness of several groundwater exploration techniques are evaluated for southern Botswana, where hydrogeological conditions are both unfavorable and relatively unknown. Livestock rearing is a major activity in this semi-arid region. Overall unit search costs (cost of 1 well in a 50-well field) are computed for 5 exploration methods: grid controlled drilling (15 trial production wells), $1500; geologically controlled drilling (10 trial production wells), $1300; long traverse geophysics (300 km resistivity/magnetic traverse with some soundings, 5 trial production wells), $3400; short and long traverse geophysics (300 km resistivity/magnetic traverse, 5 detailed sites, 2 exploratory wells), $4400; and hydrostratigraphic exploration (300 km resistivity/magnetic traverse, 5 exploratory wells, 5 trial production wells, 3 observation wells, aquifer pumping tests, and laboratory test), $6900. Costs are all bases on some return from selling successful production wells. Formulas are given to choose a suitable exploration method, given the average cost of drilling a production borehole and the success rate following use of a given exploration method. The maximum justifiable expenditure on groundwater search can be determined from average cost of drilling a production borehole and the success rate of wildcat drilling in the area. Minimum justifiable improvement in borehole success rate can be calculated from the same information. These equations revealed that in the basalt-free area, wildcat drilling or controlled drilling are economically justified. In the basalt-capped area, grid controlled drilling and geologically controlled drilling are the best choices. (Cassar-FRC)
W83-00459

THE ECONOMICS OF MUNICIPAL WASTEWATER REUSE,
Pennsylvania State Univ., University Park.
C. E. Young.
Journal of the American Water Works Association, Vol 74, No 7, p 358-361, July, 1982. 4 Fig, 1 Ref.

Descriptors: *Water reuse, *Wastewater disposal, *Economic aspects, Wastewater treatment, Wastewater composition, Municipal wastewater, Land disposal, Reclaimed water, Water conservation, Water shortage, Water supply, Water demand.

A model was developed to describe the economics of wastewater reuse. The supply and demand are illustrated in graphical form as two intersecting lines in X-form. The coordinates are: price of wastewater in dollars and amount of available wastewater in cu m. The point at which the lines intersect gives the equilibrium price and quantity. The value of the wastewater depends on quantity and quality as well as intended use. For example, a wastewater with high levels of salt, heavy metals, organics, or pathogens may be undesirable for reuse in agriculture. Conversely, nutrients and organic matter may add to its value in irrigation. Other uses require wastewaters of varying quality: corrosiveness is undesirable in industrial reuse applications; pathogens, in municipal or recreational consumption. The cost of supplying wastewater is based on quantity (large volumes cost less per unit volume than small volumes), desired wastewater characteristics (high level of treatment is more costly), and alternative disposal options. Other factors affecting the reuse of wastewater are availability of other water sources, public concerns over wastewater reuse, location of buyers and sellers of wastewater, transmission costs, and government policies. (Cassar-FRC)
W83-00465

ANALYSIS OF WATER SUPPLY COSTS IN THE WASHINGTON (D.C.) AREA,
Municipal Environmental Research Lab., Cincinnati, OH. Drinking Water Research Div.
R. M. Clark, J. I. Gillean, and J. A. Goodrich.
Journal of the American Water Works Association, Vol 74, No 7, p 6, 347-357, July, 1982. 9 Fig, 8 Tab, 21 Ref.

Descriptors: *Metropolitan water management, *Water resources development, *Planning, Water supply, Water management, Reservoirs, Water storage, Water conveyance, Baltimore, *District of Columbia.

Increasing reliance on the Potomac River as a source of water for the Washington D.C. area has prompted this study of the most cost-effective ways to ensure an extension of water supply availability. Reservoirs provide a possible solution to the Washington metropolitan area water problems. The construction of the Bloomington Reservoir has gone far toward alleviating possible problems. Use of reclaimed wastewater is an extremely expensive solution. In addition, undefined health problems may also be associated with renovated wastewater. The current risks of water shortages are small, but will increase significantly over the next 50 years, assuming current population trends continue. Consideration should also be given to the eventual construction of an additional reservoir to stabilize Potomac flow. Interconnections, although apparently attractive, are expensive, potentially damaging to the environment, and limited in capacity. Finished water connections could be encouraged to spread the peak demand. The possibility of an emergency link to the Baltimore water supply should be explored. The biggest problem in Washington Municipal Water Development may be political in nature. (Baker-FRC)
W83-00467

STEADY-STATE ECOSYSTEM MODELING FOR LAKE MANAGEMENT,
Maine Univ. at Orono. Land and Water Resources Center.
For primary bibliographic entry see Field 5G.
W83-00610

EVALUATION OF PUBLIC PARTICIPATION IN THE YADKIN-PEE DEE LEVEL B RIVER BASIN STUDY,
North Carolina State Univ. at Raleigh.
J. Wright.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-125161, Price codes: A09 in paper copy, A01 in microfiche. Water Resources Research Institute Report No 181, North Carolina State University, Raleigh, June 1982. 152 p, 6 Fig, 47 Tab, 6 Ref, 3 Append. OWRT B-120-NC(2), 14-34-0001-9126.

Descriptors: *Public participation, *Public opinion, *Surveys, *River basin development, *Regional development, Attitudes, Social participation, Policy making, Public policy, Environmental policy, River basins, Catchment areas, Water resources development, Management planning, Project planning, Education, Decision making, *North Carolina, *Yadkin-Pee Dee River basin.

For useful public participation (PP) in water resources planning, the public must learn how the planning process is organized and how they may participate effectively. A case study was made of the North Carolina PP effort in the Yadkin-Pee Dee Level B River Basin Study using observation, document analysis, and a series of surveys of various groups of public's and planners. This study addressed questions concerning: the appropriateness/utility of viewing PP in planning as an educational process; components of the PP effort, and relationships found between them and evidences of learning; factors shaping the PP effort; and problems/issues encountered. The results of this study indicated that, while more public involvement was associated with more public learning, no one technique was the most superior. Further, while planners did not develop an explicit rationale (i.e., a means-ends statement) for the PP effort, they considered it successful since no serious public objections were raised concerning the final plan. The PP effort was shaped less by preconceived ideas of representativeness, desired outcomes, and means-ends relationships than by changing demands and circumstances imposed by the nature of the planning project, the sponsoring agency, and (to a lesser extent) the publics. (Zielinski-MAXIMA)
W83-00612

ECONOMIC EVALUATION OF GROUNDWATER POLICY ALTERNATIVES IN THE NORTHERN GREAT PLAINS,
Nebraska Univ.-Lincoln. Dept. of Agricultural Economics.

For primary bibliographic entry see Field 4B.
W83-00623

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

ENERGY,
California Univ., Berkeley.
M. N. Christensen, G. W. Harrison, and L. J. Kimbell.
In: Competition for California Water, Alternative Resolutions, Engelbert, E. A., ed., University of California Press, Berkeley, 1982. p 76-97, 5 Tab, 30 Ref.

Descriptors: *Energy conversion, *Water costs, *Water demand, *Long-term planning, *Water allocation, Environmental quality, Water use, Water supply, Water use efficiency, Alternative water use, Estimated costs, Energy sources, Resource allocation, Future planning.

Rising energy costs are affecting water supply/disposal and aggregate levels of demand. In California's long-range water planning, energy is significant in that extracting and processing it consumes water; it is used to move and treat water, so its price affects supply costs; and rising prices and shifting energy resources are changing economic patterns and, thus, future demands. Five long-range variables are discussed. The first is rising energy prices which are directly tied to production costs, supply and demand, alternative energy sources, political instabilities, and rate structures. Variable 2, water used in energy production, is for now a marginal concern in terms of quantity and quality of water used. The requirements to meet levels of demand can vary, depending on the mix of supply technologies used. Variable 3, energy used in water supply, involves moving water, treating it prior to use, and treating wastewater before discharge. Rising costs will mostly affect users having a high water use ratio to product value, i.e., agriculture. Variable 4 discusses California's economy and the interrelationships of industries, i.e., how an industry's output affects others. Changing circumstances make up variable 5, and addresses marginal costs (new sources and actual costs of water/energy), externalities (environmental systems/regulations, costs not borne by end-users), and domestic and international factors. Three alternative for future water policy are: maintaining the status quo; marketlike allocations of water; and developing further supplies. Institutional changes aimed at more effective water use is the preferred approach, rather than physical development aimed at increasing supplies. (Atkins-Omniplan)
W83-00543

THE ECONOMICS OF WATER ALLOCATION,
California Univ., Davis.
For primary bibliographic entry see Field 6E.
W83-00544

THE ECONOMIC EFFICIENCY OF FLOOD PLAIN DEVELOPMENT,
Tennessee Univ., Knoxville. Dept. of Agricultural Economics and Rural Sociology.
For primary bibliographic entry see Field 6F.
W83-00545

6D. Water Demand

ANALYSIS OF WATER SUPPLY COSTS IN THE WASHINGTON (D.C.) AREA,
Municipal Environmental Research Lab., Cincinnati, OH. Drinking Water Research Div.
For primary bibliographic entry see Field 6B.
W83-00467

AGRICULTURE,
California Univ., Davis.
For primary bibliographic entry see Field 3F.
W83-00540

MUNICIPAL AND DOMESTIC USE,
California Univ., Berkeley.
W. H. Bruvold, F. G. Mittlebach, and C. Werner.
In: Competition for California Water, Alternative Resolutions, Engelbert, E. A., ed., University of California Press, Berkeley, 1982. p 37-58, 6 Fig, 2 Tab, 47 Ref.

Descriptors: *Water use, *Alternative water use, *Water scarcity, *Water supply, *Population dynamics, Municipal water, Water shortage, Competing use, Water use efficiency, Urban planning, Potable water, Consumptive use, Water rights.

The current estimate of California's urban water usage is 200 gallons per capita per day. Yearly urban consumption is about 13.5% of the total supply and, if supplies remain constant until 2020, urban use would require 20.5% of the total available. The 1980 population estimate is 23 million and is projected at 35 million in 2020; however, the growth rate will vary according to region, with nine counties in the southern part of the state expected to absorb about 56% (6.7 million people) of the additional growth. Some farmland may be converted to urban use, but in formerly heavily irrigated areas the demands may be equivalent to farm demands. Controlling urban development and conservation are critical to future water supply management. Manipulating the demand (per capita use times population) can be achieved by pricing or conservation measures, or by population growth. Limiting growth, such as by zoning regulations, has economic, legal and political implications which have not been explored fully, but it is clear that in the future stretching supplies by conservation or resue versus investing in expansion of delivery systems will be at issue. Three scenarios for California's water development as it afects urban usage are considered. The first involves increasing the supply to the urban sector; the second involves control over urban development in regions with the fastest population growth; and the third involves legal, institutional and organizational changes to support redistribution and efficient use of supplies. (Atkins-Omniplan)
W83-00541

INDUSTRY,
California Univ., Berkeley.
M. B. Teitz, and R. A. Walker.
In: Competition for California Water, Alternative Resolutions, Engelbert, E. A., ed., University of California Press, Berkeley, 1982. p 59-75, 4 Tab, 19 Ref.

Descriptors: *Industrial water, *Urban planning, *Water scarcity, *Water supply, *Market value, Water use, Economic aspects, Water shortage, Competing use, Water use efficiency, Water users, Population dynamics.

Industrial and commercial activities, including private sector manufacturing, transportation, trade and services accounts for more than 75% of California's employment and 84% of its gross income. Whereas industry only uses 6% of the water versus 86% for agriculture, it has a substantially higher output-value-to-water use ratio. Conflicts over industrial water use will probably focus on transferring water from agriculture to industrial/urban use, and developing incremental supplies for industrial development in areas where transfers are not feasible. Industry now gets water from public authorities or through self-supply (50% statewide) under private water rights or municipal systems. Projections of future demand are based on speculations about economic activity and population growth, which by 2020 is estimated at 34.9 million. Three scenarios are presented to consider supply variables. The first is the no project scenario whereby no major institutional or legal changes occur and supply changes only marginally. The second is the development scenario where development of further water supplies occurs through a series of projects without major institutional shifts, i.e., the Peripheral Canal project. The third is the reallocation scenario, whereby reallocation of water is pursued as an active policy with major changes in law and institutions providing defined and separable property rights in water; no major increase occurs in supply; and development of a marketlike system for sale and exchange of water among willing parties takes place under state sponsorship and regualtion. Industry may best be served by the last scenario. (Atkins-Omniplan)
W83-00542

ENERGY,
California Univ., Berkeley.
For primary bibliographic entry see Field 6C.
W83-00543

COLORADO WATER RIGHTS - AN ENGINEER'S CASE STUDIES,
Rice (Leonard) Consulting Water Engineers, Inc., Denver, CO.
For primary bibliographic entry see Field 6E.
W83-00675

WATER USE IN THE MISSISSIPPI GULF COAST COUNTIES, 1980,
Geological Survey, Jackson, MS. Water Resources Div.
J. A. Callahan.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO. 80225. Price codes: $7.00 in paper copy, $1.00 in microfiche. Geological Survey Open-File Report 82-512, 1982. 13 p, 2 Fig, 4 Tab, 6 Ref.

Descriptors: *Hydrologic data, *Water use, *Water supply, Industrial water, Municipal water, Groundwater, Surface water, Brackish water, *Mississippi, Mississippi Gulf Coast.

The population served by public water systems in the three counties of Mississippi's Gulf Coast increased from about 227,000 to nearly 253,000 between 1975 and 1980. Water use by public systems increased from about 27.6 million gallons per day to more than 31.3 million gallons per day. Self-supplied industrial use of ground water decreased from about 18.4 to 17.7 million per day, and that for fresh surface water increased from about 42.3 to 56.1 million gallons per day. Total freshwater was including that for rural domestic supplies, increased from about 92.0 to 109 million gallons per day. Industrial use of brackish surface water decreased from about 790 to 660 million gallons per day. (USGS)
W83-00680

6E. Water Law and Institutions

NEW DEQ WATER POLICY MORE RECEPTIVE TO CITY NEEDS,
League of Iowa Municipalities, Des Moines.
For primary bibliographic entry see Field 5F.
W83-00423

ADJUDICATORY HEARINGS AS PART OF THE NPDES HEARING PROCESS,
Washington Univ., Seattle. Dept. of Civil Engineering.
G. M. Zemansky, and R. O. Zerbe, Jr.
Ecology Law Quarterly, Vol 9, No 1, p 1-66, 1980. 279 Footnotes.

Descriptors: *Permits, *Adjudication procedure, *Water pollution control, Environmental Protection Agency, National Pollution Discharge Elimination System, Water law, Legal aspects, Regulations, Legislation, Federal Water Pollution Control Act, Public participation, Judicial decisions, Law enforcement, State jurisdiction.

Procedures for adjudicatory hearings conducted as part of the National Pollution Discharge Elimination System (NPDES) programs administered by the EPA are described. Since state-run NPDES programs can experience the same problems, it is suggested that proposed changes in the EPA permit program also be applied in the state programs. The 173 hearing requests received in Region X (Alaska, Idaho, Washington, and Oregon) from 1972-1979 are reviewed and analyzed. About 1/3 of the issued NPDES were challenged by requests for hearings. Over half of the

challenges resulted in changes favorable to the dischargers. Public participation has been minimal, limited to highly visible dischargers. Parties challenged permits for several reasons: disagreement with effluent limitations, expiration dates, or requirements for monitoring and reporting; expectation of favorable treatment; errors in the drafting stage; tactics to delay compliance; and a means of establishing communication with the agency. Reasons for delayed resolution of contested permits were: the inherent advantages in maintaining the status quo and administrative delay. Reasons for decisions favorable to 50% of the discharges were: minor nature of the challenge, failure to issue guidelines for many pollutants, breach of nondiscretionary duties by the EPA, and lack of citizen involvement. In June 1979 some changes were promulgated to correct some of the weaknesses and abuses. (Cassar-FRC)
W83-00424

PROTECTING STREAMFLOWS IN CALIFORNIA,
California Univ., Berkeley. School of Law.
A. B. Lilly.
Ecology Law Quarterly, Vol 8, No 4, p 697-723, 1980. 186 Footnotes.

Descriptors: *Instream flow, *Appropriation, Streamflow, *Legal aspects, *California, *Water law, Water rights, Water allocation, Judicial decisions, Beneficial use, Fish, Wildlife, Diversion, Political aspects, Legislation, Wild rivers, Rivers, Water management.

The protection of fish and wildlife by the same system of appropriative water rights that protect other water uses is encouraged. The development of California water law and the current administrative system of water allocation are discussed. Present strategies for protecting beneficial instream uses are inadequate. Partial protection is provided by federal and state statutes on wild and scenic rivers, statutory and common law doctrines such as the public trust doctrine, the California Water Resources Board, Constitutional restrictions, and the Water Code. However, minimum streamflows are not specified, instream values are often ignored in project design, and instream advocates must bear the burden of proof. The California Water Resources Control Board recently adopted, but failed to implement, regulations for establishing instream flow requirements to maintain beneficial instream uses. The author suggests that instream uses could compete with offstream uses more equally for available water by attaching appropriative rights to water serving instream uses. Instream appropriation permit holders would not be required to defend instream uses against each proposed offstream appropriation. Instream appropriations would also protect instream users against future exercise of dormant riparian rights. Several cases are cited in which administrative and judicial rejection of instream appropriations occurred. It is not likely that the ideal system will be adopted because of political pressures from industry and agricultural interests. (Cassar-FRC)
W83-00425

BEYOND SECTION 858: A PROPOSED GROUND-WATER LIABILITY AND MANAGEMENT SYSTEM FOR THE EASTERN UNITED STATES,
National Energy Law and Policy Inst., OK.
J. S. Lowe, L. C. Ruedisili, and B. N. Graham.
Ecology Law Quarterly, Vol 8, No 1, p 131-161, 1979. 135 Footnotes.

Descriptors: *Water law, *Liability, *Water management, *Legal aspects, Wisconsin, American rule, *Groundwater management, Water rights, Water pollution, Beneficial use, Water use, Water transfer, Water shortage, Water allocation, Appropriation, Administration, Judicial decisions, Regulations.

Problems with present groundwater liability rules and a proposed solution for management in the eastern U.S. are presented. The common law of absolute ownership of groundwater was abandoned by most states shortly after 1900 and replaced with the American rule of reasonable use. This restricted a landowner's groundwater rights by permitting reasonable withdrawals. The rigidity of the American rule takes no account of the relative values to the community of different water uses. A landowner can use, or even waste, groundwater on his premises as long as it does not affect the neighboring users. On the other hand, a user is liable for damages if he harms other landowners even in the process of using water for acceptable purposes. In 1974 Wisconsin adopted the Second Restatement of Torts' modification of the American rule: Section 858. The Restatement incorporates all the grounds of liability recognized by common law but removes some of the defenses against liability by weighing the value of different uses. Section 858 has been criticized because it does not consider water shortage situations, is uncertain, frustrates good planning, and does not protect the public interest in preservation of groundwater quality and quantity. Proposed modifications to these laws would consider the differences between locations liberally endowed with clean water and those facing shortages and pollution. In the noncritical areas the first user principle, the priority use rule, and the comparative cause rule are more suitable than Section 858. In case of critical groundwater areas new laws are necessary to allow a government agency to manage groundwater under 3 classifications of problem areas: emergency critical, temporary critical, and permanent. These proposed changes in the law would provide a mechanism for controlling water use in the event of shortage or degradation. (Cassar-FRC)
W83-00439

THE GANGES BASIN AND THE WATER DISPUTE,
Ministry of Power, Water Resources and Flood Control, Dacca (Bangladesh).
For primary bibliographic entry see Field 4A.
W83-00455

EAST IS WEST AND WEST IS WEST: HAVE THE TWAIN MET.,
T. E. Cahill.
Journal of the American Water Works Association, Vol 74, No 7, p 4, 332-333, July, 1982. 15 Ref.

Descriptors: *Water rights, *Legal aspects, *Water shortage, Water demand, Water resources development, Riparian rights, Colorado, Property rights.

States in which water use laws are based on the riparian doctrine are becoming increasingly aware of the limitations of this ancient common law. From Biblical times up till the moment of the Industrial Revolution, water was still used mainly to run small gristmills and for domestic purposes. Even so, legal issues of these times were supported by the idea that there could be property rights to the use of running water which stemmed from the rights of those through whose land the stream flowed. As more and bigger industries found greater need forwater, either as a power source or for waste disposal, the riparian doctrine emerged. Early cases established the 'natural flow' theory. The 'reasonable use' theory then emerged, which modified the natural flow doctrine and put emphasis on a full and beneficial use of the advantages of the stream or lake and gave each riparian proprietor a privilege to make a reasonable use of water for any purpose, provided only that such use did not cause harm to the reasonable uses of others. Conflicts between miners and irrigators caused the Colorado Supreme Court to hold that riparian rights were unsuitable for the arid west. Prior appropriation was Colorado's common law. As competition for diminishing water supplies increased outside the West, the state legislatures became more and more involved in water allocation. Ample evidence exists to demonstrate that existing uses will be protected in water-short areas, and as shortages intensify, simple statutes will become more complex. (Baker-FRC)
W83-00464

NATIONAL DRINKING WATER ADVISORY COUNCIL AND WATER UTILITY COUNCIL: WHAT DO THEY DO.,
Manchester Water Works, NH.
For primary bibliographic entry see Field 5G.
W83-00503

THE ECONOMICS OF WATER ALLOCATION,
California Univ., Davis.
R. E. Howitt, D. E. Mann, and H. J. Vaux, Jr.
In: Competition for California Water, Alternative Resolutions, Engelbert, E. A., ed., University of California Press, Berkeley, 1982. p 76-97, 1 Fig, 6 Tab, 37 Ref.

Descriptors: *Resource allocation, *Water scarcity, *Water demand, *Cost-benefit analysis, Water supply, *Water exchange, Water rights, Model studies, Agriculture, Industrial constraints, Electric power costs, Water districts, Market value, Marginal costs.

Water institutions that have served California well in the past are not well-suited to either current conditions or those anticipated for the next 40 years. Three water use scenarios are examined using an interregional trade model to illustrate some costs associated with preserving current institutions in the face of increasing competition for water. Water could be transferred between geographical regions and between agricultural and urban sectors, and would occur when a potential user is willing to pay the market price, plus transportations costs. Temporal changes in supply, demand, and transfer prices are estimated in the model beginning with 1980 and continuing through 2020. In scenario one, it is assumed that current institutions are maintained and no new water supplies are made available. Water prices will increase sharply in response to increased energy costs and competition. In scenario two, current institutions are maintained and new supplies are made available when users are willing to defray their costs. Urban sectors will benefit from the new supplies and see large reductions in water prices and modest increases in quantities available. Regional and sectoral markets would be allowed in scenario three, permitting voluntary trading of water. Northern agriculture would sell to the northern urban sector, and the Imperial Valley would sell to the southern urban areas. This limited marketlike system would save up to 2 million acre-feet of water annually and would benefit buyers and sellers in an amount over $70 million in 1980 and $83 million in 2020. These institutional changes are only a fraction of the costs of capital facilities to produce similar benefits. (Atkins-Omniplan)
W83-00544

OIL SPILL CLEANUP FULFILLS AIM OF FEDERAL WATER POLLUTION CONTROL ACT,
For primary bibliographic entry see Field 5G.
W83-00566

'PLAIN MEANING' DECISION CLARIFIES STANDARD FOR EFFLUENT LIMITATIONS,
S. Weckesser.
Natural Resources Journal, Vol 22, No 2, p 455-465, April, 1982. 71 Ref.

Descriptors: *Effluent limitations, *Legal aspects, *Water pollution control, Technology, Cost analysis, Financial aspects, *Water quality standards.

The Administrator of the EPA is authorized under the Clean Water Act to promulgate effluent limitations for private industrial sources. Conventional pollutants are subject to the best conventional pollutant control technology standard (BCT). Thirty-four paper and chemical manufacturers, food processing companies and trade associations sought judicial review of the actions challenging the BCT regulations on several grounds. The petitioners argued that the statute required EPA's proposed BCT guidelines to pass two reasonableness tests. EPA responded that the statute did not require a cost-effectiveness test, but rather only a POTW (publicly owned treatment works) cost-comparison standard to arrive at BCT regulations for industry.

EPA contended that the second clause in the relevant portion of the statute set forth the benchmark of reasonableness required by the first clause. In the present case the decision is an economic victory for the industries in that the fourth circuit's decision held that the statute required a cost-effectiveness test. The American Paper Institute's counsel reported that EPA rules, had they been upheld, would have cost $2 billion for almost no clean-up at all. A point always exists at which the costs of pollution control are no longer warranted by resulting incremental benefits. EPA's evaluation of the reasonableness of the costs would seem to have given adequate consideration to the incremental benefits as compared to the costs. It is felt that this decision may lead to lower standards, allowing a greater discharge of conventional pollutants. In addition, the process of conducting this test will lead to delay in promulgation of standards, and delay means economic benefits to industry. (Baker-FRC)
W83-00567

PALEFACE, REDSKIN, AND THE GREAT WHITE CHIEFS IN WASHINGTON: DRAWING THE BATTLE LINES OVER WESTERN WATER RIGHTS,
B. K. Orem.
San Diego Law Review, Vol 17, No 2, p 449-489, March, 1980. 194 Footnotes.

Descriptors: *Water rights, *Reservation doctrine, *Jurisdiction, Water law, Semiarid lands, Legal aspects, Water allocation, Water shortage, Winters doctrine, Indians, Adjudication procedure, State jurisdiction, Federal jurisdiction, Relative rights, Judicial decisions.

The conflicts among Indian and federal reserved water rights (Winters doctrine) and state vested water rights in the semiarid Western U.S. are examined. The legally superior federal reserved water rights preempt later dated state water claims. This situation disrupts state water systems and frustrates sound planning. Indians claim expansive reserved water rights under the doctrine of implied reservation of water rights. This involves marketing of water for off-reservation uses, destroying state water management schemes and possibly preempting established uses. Conflicts exist between federal and state claims, between federal and Indian claims, and between state and federal-Indian claims. Although the Supreme Court has recently limited reserved water rights for non-Indian federal reservations to the original purposes, powerplants, energy development, and water marketing are not included. Until the conflicts are settled by permanently quantifying Indian and federal rights in coordination with state laws, water users face possible loss of water rights without compensation. (Cassar-FRC)
W83-00584

NATIONAL ACID PRECIPITATION ASSESSMENT PLAN.
For primary bibliographic entry see Field 5G.
W83-00607

AN ECONOMIC EVALUATION OF CITIZEN SUITS,
Clemson Univ., SC. Dept. of Economics.
H. H. Macaulay, and C. W. Van Deusen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-125229, Price codes: A05 in paper copy, A01 in microfiche. Water Resources Research Institute Technical Report No 94, Clemson University, Clemson, South Carolina, August 1981. 76 p, 49 Ref. OWRT B-104-SC(1), 14-34-0001-7185.

Descriptors: *Economic evaluation, *Legal review, *Liability, *Public rights, *Water pollution, Economic aspects, Public participation, Civil law, Legal aspects, Law enforcement, Building codes,Judicial decisions, Negligence, Ordinances, Regulations, Environmental effects, South Carolina.

Water pollution problems can be analyzed in economic terms as scarcity of an asset whose use is sought by many. Some groups, however, have not enjoyed as much of their preferred use of water quality as they would like at the effective zero price, and have reported to litigation. Courts traditionally have not granted standing to prospective litigants unless the latter could show damage resulting from illegal action by another party. Those seeking their preferred uses through the courts have generally desired environmental purity. This position is popular, and courts have often granted standing where damage has occurred, ignoring the requirement that there must also be a violation of law. Damage frequently occurs whenever one party outbids/undersells another, but such activities are not illegal and do not justify standing. Some laws of the 1970's have granted standing (and therefore, property rights), by allowing citizen suits. Further, by allowing suits based on damage, the courts have, in effect, created new property rights, but decisions in most of these cases have reflected political rather than economic considerations. While certain individuals/groups have property rights in the environment, the rights are not saleable/useable by owners in alternative ways. Hence, the results will create economic inefficiency. (Zielinski-MAXIMA)
W83-00619

LEGAL LIABILITY OF RECLAIMED WATER SYSTEM PROPRIETORS,
Brown and Caldwell, Pasadena, CA.
H. Zeitzew.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-125237, Price codes: A11 in paper copy, A01 in microfiche. Office of Water Research and Technology, Water Reuse Report OWRT/RU-82/5, November 1980. 2 Fig, 6 Tab, 200 Ref, 4 Append. C-90118-R(9455)(1), 14-34-0001-9455.

Descriptors: *Reclaimed water, *Liability, *Civil law, *Regional analysis, *Environmental protection, Evaluation, Legal aspects, Legal review, Western U.S., Damage, Water reuse, Wastewater renovation, Public health, Public rights, Environmental impact statement, Environmental effects.

An evaluation was made of the legal liability of proprietors of reclaimed water systems under existing civil law in five arid western States (Arizona, California, Colorado, Nevada, and New Mexico) where opportunities of water reuse were believed to be the greatest. Model regulatory procedures and legislative enactments were developed and proposed to overcome the identified existing legal barriers to water reuse. This evaluation primarily addressed the point of view of a potential defendant (i.e., the supplier of the reclaimed water) in a lawsuit brought by an injured plaintiff as a means of alerting potential defendants of their possible vulnerability under laws of product liability (and other relevant legal theories), and to propose effective preventive measures. Three areas are discussed: potential health risks associated with specific reuse applications; a review of legal theories under which liability for damages could be imposed; and a compilation of the elements of an effective product integrity and injury prevention program which would minimize potential health risks and potential exposure to liability for damages. Potential liability could constitute a similar barrier to expanded water reuse in other States. (Zielinski-MAXIMA)
W83-00620

COLORADO WATER RIGHTS - AN ENGINEER'S CASE STUDIES,
Rice (Leonard) Consulting Water Engineers, Inc., Denver, CO.
G. W. Fassett.
Journal of the American Water Works Association, Vol 74, No 7, p 4, 324-331, 1982. 3 Fig, 4 Tab, 2 Ref.

Descriptors: *Water rights, *Water allocation, *Legal aspects, Hydraulic engineering, Water use, Water resources development, Resource allocation, Available water, Water supply, Water demand, *Colorado.

The studies water engineers must make to support a contemplated change in the use and diversion point of water rights under the prior appropriation doctrine are described. The growing community of Aurora, Colorado, a suburb of Denver, must acquire rights to additional water for municipal use. In order to determine as nearly as possible the actual amount of available water that previously has been used for agricultural irrigation detailed engineering studies were required. It was also necessary to determine the influence of groundwater on the consumptive use of the irrigated pasture. To determine the transferable consumptive use associated with applied irrigation water, procedures were developed that encompassed all of the technical considerations previously used. In the second case study, the need to augment water supplies for the Telluride, Colorado ski area is discussed. As with the first case, an augmentation plan, supported by detailed water rights engineering studies, must be filed with the Colorado water court for approval. All appropriators within the San Miguel River watershed have an opportunity to object to the proposed plan and to protest evidence if they believe implementation of the plan will injure their water rights. Under the doctrine of prior appropriation, water is allocated on a first in time, first in right basis, and water users' vested rights are protected from injury through a system of procedures based on statutory and case law. The application of these procedures to the development of water resources requires water rights engineering involving a full range of hydrologic and hydraulic techniques. (Baker-FRC)
W83-00675

6F. Nonstructural Alternatives

DECENTRALIZING WATER RESOURCE PLANNING AND MANAGEMENT,
Prince (Malcolm), Inc., Buffalo, NY.
For primary bibliographic entry see Field 6B.
W83-00454

THE ECONOMIC EFFICIENCY OF FLOOD PLAIN DEVELOPMENT,
Tennessee Univ., Knoxville. Dept. of Agricultural Economics and Rural Sociology.
W. M. Park, and W. L. Miller.
Water Resources Research Center Technical Report No 141, May, 1982. Purdue University, West Lafayette, Indiana. 84 p, 7 Fig, 2 Tab, 52 Ref.

Descriptors: *Economic efficiency, *Cost-benefit analysis, *Floods, *Flood plain zoning, *Resource allocation, Costs, Insurance, Social costs, Flood control, Maximum probable floods, Flood damage, Regression analysis, Model studies, Public policy, Planning.

In recent years, concern has increased over the rise in real average annual damages due to flooding. Federal flood control policies may have accelerated the problem because of expectations of future improvements and a downplaying of flood danger. This study examines resource allocation and develops a theoretical framework to analyze flood plain development decisions. Traditional nonstructural flood control measures include flood insurance and restrictive zoning. A multiple regression model was used to determine the significance of social welfare losses from resource over-allocation. Logansport, Indiana was studied to explore the extent of over-allocation in flood prone areas and to assess alternative corrective policies. The model's basic conclusions are that before the Federal Flood Insurance Program of 1974, residential property values were less than fully discounted for the flooding potential; overdevelopment had occured and there were social welfare losses. When an insurance program, via its premiums, reflects the expected annual flood damage on each parcel of land, the market would allocate land to its most productive use and guide investment decisions to the optimal level. However, the program costs of the market-related insurance alternative might favor zoning restrictions, even when social welfare losses from zoning bans on development are included. The insurance alternative could cost four to ten times the cost of the simple zoning alternative, which is estimated at $38,000 to $60,000. Logansport would benefit from a management

strategy and zoning restrictions would provide improved resource allocation at a lower cost than the Federal Flood Insurance Program. (Atkins-Omniplan)
W83-00545

TREATMENT COSTS SAVINGS THROUGH MONTHLY VARIABLE EFFLUENT LIMITS,
Jordan, Jones and Goulding Inc., Atlanta, GA.
H. F. Reheis, J. C. Dozier, D. M. Word, and J. R. Holland.
Journal of the Water Pollution Control Federation, Vol 54, No 8, p 1224-1230, August, 1982. 5 Fig, 2 Tab, 8 Ref.

Descriptors: *Standards, *Effluent limitations, *Costs, Dissolved oxygen, Operating costs, Capital costs, Seasonal variation, Oxygen, Wastewater treatment, Advanced wastewater treatment, *Georgia.

A method for developing monthly variable effluent limits is based on estimating the 7-day 10-year minimum streamflows (7Q10) for each month rather than the yearly 7Q10. The monthly minimum streamflows are used with monthly stream temperature and other water quality characteristics in a dissolved oxygen model to calculate the effluent limits to meet stream standards. Generally, effluent standards are most stringent in the dry months of summer and early autumn. The flexibility of these standards allows some municipalities to discharge secondary effluent for 4-5 months of the year and use advanced treatment for the remaining months, saving considerable treatment costs compared with year-round advanced treatment. Application of this method was made to 19 treatment facilities in Georgia, revealing possible savings of up to 16% in capital costs and up to 19% in operating costs. It was estimated that use of monthly variable effluent limits by wastewater treatment facilities in the state of Georgia could save $50 million in capital costs and $4.2 million in annual operating costs. On a national scale, application of the method could save hundreds of millions of dollars annually. (Cassar-FRC)
W83-00660

6G. Ecologic Impact Of Water Development

COASTAL ZONE DEVELOPMENT: MITIGATION, MARSH CREATION, AND DECISION-MAKING,
Stanford Univ., CA. Program in Human Biology.
M. S. Race, and D. R. Christie.
Environmental Management, Vol 6, No 4, p 317-328, July, 1982. 3 Tab, 50 Ref.

Descriptors: *Wetlands, *Marsh management, *Coastal zone management, Marshes, Salt marshes, Decision making, Mitigation, Coastal marshes, Estuaries, Regulations, Environmental effects, Planning, Aquatic habitats, Water policy, Permits, Marsh plants, Vegetation, Land development, Dredging, Fill permits.

Marsh creation as a mitigation technique should not be used to justify destruction of natural wetlands and substitution with man-made marshes. Marsh creation may be effective in minimizing damage caused by construction, in abating shoreline erosion, and in returning degraded coastlands to tidal influence. Although the net acreage of wetlands may not change as a result of mitigation of development, there is insufficient evidence that man-made marshes are comparable to natural marshes in structure and function. Different states have varying requirements for wetlands mitigation. These are reviewed for 11 coastal states. Mitigation policies in one area may not be applicable to other regions or may adversely affect other estuarine habitats. Decision makers must not be influenced by developers who prepare extensive mitigation plans to justify destruction of natural marshes. This is especially critical in areas where natural wetlands have already been reduced by extensive filling and development. Rather, decisions should be based on: (1) the fact that present knowledge of ecological effects of marsh creation is still limited, (2) the trade-offs involved, and (3) the state's defined standards and policies. (Cassar-FRC)
W83-00430

THE ENCOURAGEMENT OF FRESHWATER CRAYFISH POPULATIONS BY ATTENTION TO THE CONSTRUCTION AND MAINTENANCE OF WATERWAYS,
J. B. Hogger, and R. S. Lowery.
Journal of the Institution of Water Engineers and Scientists, Vol 36, No 3, p 214-220, May, 1982. 2 Fig, 3 Tab, 11 Ref.

Descriptors: *Dredging, *Channel improvement, *Crayfish, Environmental effects, Aquatic habitats, Ware Lock, Lee River, Beane River, *England, Channels, Navigation, Navigation canals.

The impact of river engineering works on fresh water crayfish (Austropotamobius pallipes) was investigated in Hertfordshire in the River Lee and Ware and the River Beane at Hertford. This crustacean, about 9 cm long, is a popular food animal. Construction at the Ware Lock site (1974-76) consisted of channel dredging and installation of sheet pilings, a weir, and weir basin. Sampling in 1979 showed substantial numbers of crayfish in the new weir basin as well as at sites where they were found previously in the lock and lock bypass channel. In the Beane, dredging removed silt and bank plants. Many crayfish were found living among plant roots in a stretch of the river considered unsuitable habitat for these animals. The number of crayfish removed by dredging was reduced 35% by rinsing the dredged material in the river before depositing it on the bank. To encourage colonization and growth of the crayfish populat ions, river engineering works should include installation of rough, creviced material such as broken rocks, to provide desirable habitats. During dredging as many crayfish as possible should be returned to the water from the dredged material. (Cassar-FRC)
W83-00505

THE IMPACT OF DAMMING THE DON RIVER ON THE NATURAL REPRODUCTION OF THE DIADROMOUS SHAD,
Akademiya Nauk URSR, Kiev. Inst. Hidrobiologii.
V. I. Mogil'chenko.
Hydrobiological Journal, Vol 17, No 3, p 105-106, 1981.

Descriptors: *Fish populations, *Dam effects, *River flow, *Shad, Don River, Azov Sea, *USSR, Environmental effects, Fish eggs, Spawning, Salinity, Temperature, Velocity, Water resources development, Water currents.

Damming of the Don River in 1952 reduced shad spawning grounds by half and markedly changed river flow. Compared with the flow before damming, spring flow is less than half, average current velocity in spawning areas is 2-2.5 times less, maximum flow is less than half (1 m per sec), spring water temperatures 1-3C less, and salinity in the Azov Sea is greater. After river regulation the larger variety of the Don shad became dominant over the smaller variety. During low flow years the first 2 batches of eggs are only 50% viable and the third batch is resorbed. Although the shad population has been reduced, the average size and weight have increased. The proportion of females has increased from 33% to 52%. (Cassar-FRC)
W83-00593

POWER INDUSTRY WASTES,
Tennessee Valley Authority, Chattanooga.
For primary bibliographic entry see Field 5G.
W83-00657

7. RESOURCES DATA

7B. Data Acquisition

INSTRUMENTS FOR MOUNTAINOUS AREAS,
Institute of Hydrology, Wallingford (England).
I. Strangeways.
Nordic Hydrology, Vol 12, No 4/5, p 289-296, 1981. 5 Fig, 8 Ref.

Descriptors: *Measuring instruments, *Mountains, *Hydrologic data, *Climatic data, Data acquisition, Basins, Automation, Snow, Ice, Precipitation, Wind, Humidity, Temperature, Radiation, Snowmelt, Weather forecasting, *Scotland.

An automated weather station which measures solar and net radiation, air temperature and humidity, wind speed and direction, and rainfall was developed in 1965 and is presently being used in about 60 locations around the world. The original unit was developed for use in sites having altitudes up to about 600 meters. However, snow and ice problems interfered with reliable operation of the station in the Scottish highlands, rendering the station useless for much of the winter. Alternative techniques for use in mountainous areas are being investigated. The summit of Cairn Gorm in Scotland is being used as a proving ground for experimental methods of preventing ice accretion, new ways of deploying temperature sensors, alternative ways of exposing radiation sensors consistent with the deicing techniques, the use of static sensors for wind measurements, selection of the most appropriate method of sensing humidity, and new ways to measure rain and snowmelt. Although the initial objective was to develop an automated weather station specifically for mountainous climates, the extensive modifications have led to plans to develop a new style, general purpose automated station applicable to a wide variety of climates, including mountainous ones. (Carroll-FRC)
W83-00361

AN AUTOMATIC VOLTAMMETRIC ANALYZER FOR THE SIMULTANEOUS DETERMINATION OF TOXIC TRACE METALS IN WATER,
Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Angewandte Physikalische Chemie.
P. Valenta, L. Sipos, I. Kramer, P. Krumpen, and H. Rutzel.
Fresenius' Zeitschrift fur Analytische Chemie, Vol 312, No 2, p 101-108, 1982. 7 Fig, 4 Tab, 23 Ref.

Descriptors: *Trace metals, *Water analysis, *Automation, *Pollutant identification, Metals, Heavy metals, Control systems, Computers, Cadmium, Lead, Copper, Zinc, Voltammetry.

An automatic voltammetric analyzer for trace metals in water is based on microprocessor technology. It comprises a polarograph with the differential pulse mode, circuitry for automatic adjustment of current sensitivity for each peak, a microprocessor-based controller, a automatic hanging mercury drop electrode, and a printer-plotter. Software consists of 2 independent programs, the parameter input program and the analysis control program. The parameter input program recalls the respective step name and the parameter name. The analysis control program initiates all operations necessary after switching on the power and controls the execution of subsequent steps. This allows adjustment of optimal parameters before every analysis. Subroutines are used to avoid repeating the whole analysis. The printout shows the whole voltammetric curve, energy peaks in an optimal current sensitivity range, and important information about the analysis. Several months of use have shown that performance is very satisfactory. The complete simultaneous determination of Cd, Pb, Cu, and Zn takes 20 min. Accuracy up to 3% can be attained. Detection sensitivity is 0.1 micrograms per liter. (Cassar-FRC)
W83-00510

OBSERVATIONS FROM MOORED CURRENT METERS IN SAN FRANCISCO BAY, 1978.
Geological Survey, Menlo Park, CA. Water Resources Div.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: $8.00 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 82-153, September 1981. 91 p, 2 Fig, 1 Tab, 4 Ref, 3 Append. (Gartner, J.W., and Cheng, R.T., compilers).

Descriptors: *Data collections, *Estuaries, *Current meters, Water currents, Tidal currents, Water temperature, Salinity, *San Francisco Bay, California.

Current-meter data collected at eight stations in the San Francisco Bay estuarine system between August 1978 and December 1978 are compiled in this report. The measurements include current speed and direction, and water temperature and salinity (computed from conductivity and temperature). Data are presented in graphical format with each parameter plotted separately. (USGS)
W83-00551

SPECIFICATION FOR PROCUREMENT OF WATER-LEVEL SENSING INSTRUMENTATION, SPECIFICATION NUMBER HIF-I-1,
Geological Survey, NSTL Station, MS. Water Resources Div.
D. H. Rapp.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: $3.50 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 82-89, January 1982. 24 p, 2 Tab, 3 Ref.

Descriptors: *Measuring instruments, *Specifications, *Classification, *Water level recorders, Design standards, Errors, Testing procedures, Surface water, Gaging station, Water measurement.

This specification is to communicate to instrument manufacturers the U.S. Geological Survey's requirements. It covers systems for sensing the elevation of the water surface on open channels, rivers, lakes, reservoirs, storm-sewer pipes, and observation wells at Survey data-collection sites. The signal output (mechanical or electrical) must meet the signal input requirements of analog to digital and digital input recorders in use by the Survey. A classification of stage-sensing systems by common characteristics is used to aid Survey people making system selections. These characteristics are (1) system type (contact or noncontact), (2) sensor type and sensing distance, (3) accuracy, (4) range, (5) power requirements, (6) system size and weight, and (7) data output signal. Acceptable system requirements cover system configurations, signal outputs, materials, operation manuals, detailed environmental conditions, calibration procedures, system accuracy, power requirements, installation limitations, maintainability, safety, and workmanship. An outline of the qualification test procedures and failure criteria are also given. The Hydrologic Instrumentation Facility at NSTL Station, Mississippi will test available systems to determine if they meet the specification in this report for inclusion in the Survey's 'Qualified Products List'. This list will be used for future procurement of water-level sensing systems by the Survey. (USGS)
W83-00684

ACOUSTIC SYSTEMS FOR THE MEASUREMENT OF STREAMFLOW,
Geological Survey, Portland, OR. Water Resources Div.
A. Laenen, and W. Smith.
Available from the OFSS, USGS Box 25425, Price: $6.75 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 82-329, 1982. 45 p, 19 Fig, 4 Tab, 12 Ref.

Descriptors: *Flowmeters, *Streamflow, *Acoustics, *Flow measurement, Velocity, Electrical equipment, Stream gages, Discharge measurement, Flow rates, *Acoustic velocity meter.

Very little information is available concerning acoustic velocity meter (AVM) operation, performance, and limitations. This report provides a better understanding about the application of AVM instrumentation to streamflow measurment. Operational U.S. Geological Survey systems have proven that AVM equipment is accurate and dependable. AVM equipment has no practical upper limit of measureable velocity if sonic transducers are securely placed and adequately protected, and will measure velocitites as low as 0.1 meter per second which is normally less than the threshold level for mechanical or head-loss meters. In some situations the performance of AVM equipment may be degraded by multipath interference, signal bending, signal attenuation, and variable streamline orientation. Smaller, less-expensive, more conveniently operable microprocessor equipment is now available which should increase use of AVM systems in streamflow applications. (USGS)
W83-00692

7C. Evaluation, Processing and Publication

SNOW SURFACE MEASUREMENTS FROM DIGITAL LANDSAT MSS DATA,
Eidgenoessische Technische Hochschule, Zurich (Switzerland). Inst. for Communication Technology.
J. Lichtenegger, K. Seidel, M. Keller, and H. Haefner.
Nordic Hydrology, Vol 12, No 4/5, p 275-288, 1981. 6 Fig, 3 Tab, 9 Ref.

Descriptors: *Satellite technology, *Snow cover, Mountains, Data acquisition, Remote sensing, Prediction, Runoff, Clouds, *Switzerland, Dischmal-Valley basin, Vorderhein basin.

Snow cover is an important parameter in models used to predict runoff in high mountain areas. Although conventional interpretation methods have been used for some operational applications of satellite data, methods using digital data are not yet fully operational. A new method uses multispectral Landsat data together with a digital terrain model (DTM) to monitor snow cover in various watersheds in a manner which satisfies both the specific requirements of the rugged mountain topography of the Alps and the high accuracy standards of the European user community. This digital interpretation system is designed to provide input data for a runoff model providing a short to medium range water runoff forecast. This technique was used to analyze a watershed encompassing about 1,500 square kilometers. Landsat data were registered to a DTM using a reflectance map. A high correlation was found between the image derived using this method and the real image. The resultant data set for each surface element includes the spectral properties, an elevation zone, an exposure, a slope angle, and a brightness value. The shadowed areas can be detected during the classification process, and radiometric corrections can be made with respect to the incident radiation angle. As a result, snow coverage data within a climatologically similar region can be extrapolated from analysis of a small and representative section of the area involved. Areas partially under cloud cover can be evaluated by this method using data from a small cloud free zone in the area. (Carroll-FRC)
W83-00362

WATER QUALITY MONITORING: WHAT DIRECTIONS SHOULD NEW PROGRAMS TAKE,
Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering.
For primary bibliographic entry see Field 5A.
W83-00429

WATER RESOURCES AND ENVIRONMENTAL PLANNING USING INTERACTIVE GRAPHICS,
Cornell Univ., Ithaca, NY.
For primary bibliographic entry see Field 6A.
W83-00456

WATER RESOURCES DATA FOR ARIZONA, WATER YEAR 1980.
Geological Survey, Tucson, AZ. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as Geological Survey Water-Data Report AZ-80-1, February 1982. 568 p, 8 Fig.

Descriptors: *Hydrologic data, *Surface water, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Wells, Water level, Data collections, Sites, Arizona.

Water resources data for the 1980 water year for Arizona consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; water levels of observation wells; and quality of ground water. This report contains discharge records for 240 gaging stations, annual peaks for 61 crest-stage partial-record stations, and discharge measurements at 14 miscellaneous sites; contents only records for 9 lakes and reservoirs; stage and contents for 1 lake, elevation and discharge for 1 streamflow station; elevation only for 1 streamflow station; gage height only for 1 head over a dam; 16 supplementary records, included with gaging-station records, consisting of monthend or monthly stage, contents, and evaporation of lakes and reservoirs, diversions, and return flows; water-quality records for 62 continuous-record stations and 9 miscellaneous sites; water levels for 93 observation wells; and water-quality data for water from 741 wells. The data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating Federal and State agencies in Arizona. (USGS)
W83-00546

WATER RESOURCES DATA FOR WASHINGTON, WATER YEAR 1980--VOLUME 2. EASTERN WASHINGTON.
Geological Survey, Tacoma, WA. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-102707, Price codes: A15 in paper copy, A01 in microfiche. Geological Survey Water-Data Report WA-80-2, 1981. 332 p, 19 Fig.

Descriptors: *Hydrologic data, *Surface water, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Wells, Water level, Data collections, Sites, *Washington, Eastern Washington.

Water resources data for the 1980 water year for Washington consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of ground-water wells. This report in two volumes contains records for water discharge at 233 gaging stations, stage only at 5 gaging stations, stage and contents at 41 lakes and reservoirs, and water quality at 39 gaging stations (including 6 lakes and reservoirs) and 100 wells, and water levels at 164 observation wells. Also included are data for 14 crest-stage and 89 water-quality partial-record stations. Additional water data were collected at various sites not involved in the systematic data-collection program and are published as miscellaneous measurements and analyses. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State, local, and Federal agencies in Washington. (USGS)
W83-00547

WATER RESOURCES DATA FOR WASHINGTON, WATER YEAR 1980--VOLUME 1. WESTERN WASHINGTON.
Geological Survey, Tacoma, WA. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-105734, Price codes: A22 in paper copy, A01 in microfiche. Geological Survey Water-Data Report WA-80-1, 1981. 488 p, 22 Fig.

Descriptors: *Hydrologic data, *Surface water, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Wells, Water level, Data collections, Sites, *Washington, Western Washington.

Water resources data for the 1980 water year for Washington consist of records of stage, discharge,

and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality of ground-water wells. This report in two volumes contains records for water discharge at 233 gaging stations, stage only at 5 gaging stations, stage and contents at 41 lakes and reservoirs, water quality at 39 gaging stations (including 6 lakes and reservoirs) and 100 wells, and water levels at 164 observation wells. Also included are data for 14 crest-stage and 89 water-quality partial-record stations. Additional water data were collected at various siites not involved in the systematic data-collections program and are published as miscellaneous measurements and analyses. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State, local, and Federal agencies in Washington. (USGS)
W83-00548

WATER RESOURCES DATA, NEW YORK, WATER YEAR 1981--VOLUME 1. EASTERN NEW YORK EXCLUDING LONG ISLAND.
Geological Survey, Albany, NY. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-107334, Price codes: A15 in paper copy, A01 in microfiche. Geological Survey Water-Date Report NY-81-1, 1982. 318 p, 5 Fig, 1 Tab.

Descriptors: *Hydrologic data, *Surface water, *Groundwater, *Water quality, Gaging stations, Stream flow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Wells, Water level, Data collections, Sites, *New York, Eastern New York excluding Long Island.

Water resources data for the 1981 water year for New York consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels of ground-water wells. This volume contains records for water discharge at 105 gaging stations, stage only at 6 gaging stations; and stage and contents at 4 gaging stations and 19 other lakes and reservoirs; water quality at 29 gaging stations, 5 precipitation stations and 4 partial-record stations; and water levels at 23 observation wells. Also included are data for 50 crest-stage and 14 low-flow partial-record stations. Additional water data were collected at various sites not involved in the systematic data-collection program and are published as miscellaneous measurements and analyses. These data together with the data in Volumes 2 and 3 represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State, local, and Federal agencies in New York. (USGS)
W83-00549

STATISTICAL SUMMARIES OF WATER-QUALITY DATA FOR TWO COAL AREAS OF JACKSON COUNTY, COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
G. Kuhn.
Available from the OFSS, USGS, Box 25425, Fed. Ctr. Denver, CO 80225, Price: $3.50 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 82-121, 1982. 23 p, 3 Fig, 9 Tab, 13 Ref.

Descriptors: *Hydrologic data, *Water quality, *Streams, *Baseline studies, Mathematical studies, Regression analysis, *Colorado, Jackson County, Coalmont, Canadian River.

Statistical summaries of water-quality data are compiled for eight streams in two separate coal areas of Jackson County, Colo. The quality-of-water data were collected from October 1976 to September 1980. For inorganic constituents, the maximum, minimum, and mean concentrations, as well as other statistics are presented; for minor elements, only the maximum, minimum, and mean values are included. Least-squares equations (regressions) are also given relating specific conductance of the streams to the concentration of the major ions. The observed range of specific conductance was 85 to 1,150 micromhos per centimeter for the eight sites. (USGS)
W83-00550

JANUARY 1981 WATER LEVELS, AND DATA RELATED TO WATER-LEVEL CHANGES, WESTERN AND SOUTH-CENTRAL KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
M. E. Pabst.
Geological Survey Open-File Report 81-1001, 1981. 168 p, 2 Fig, 1 Tab.

Descriptors: *Groundwater, *Water level, *Hydrologic data, *Water level fluctuations, Observation wells, Irrigation, Groundwater recharge, Aquifers, *Kansas, *Western Kansas, *South-central Kansas.

Water-level measurements were made, mostly in January 1981, in about 1,475 wells in western and south-central Kansas. The measurements were made in mid-winter when pumping was minimal and water levels had recovered, for the most part, from the effects of pumping during the previous irrigation season. Annual hydrologic data are provided for relating water-level changes from a 'base-reference year' (predevelopment year), a year of abnormally high rainfall and minimum pumpage (1966 or 1974), and each of seven consecutive years of measurement (1975-81). The 'base-reference year' is designated as 1940 for the southwestern area, 1944 for the south-central area, and 1950 for the northwestern and west-central areas. Water levels for the 'base-reference year' are established by measurements made during that year and by interpretation of maps showing water-level altitudes. Data also are provided for relating the average annual water-level changes, saturated thicknesses of the deposits, and percentage changes in saturated thicknesses. (USGS)
W83-00553

GEOHYDROLOGY OF THE PREGLACIAL GENESEE VALLEY, MONROE COUNTY, NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
R. M. Waller, T. J. Holecek, K. I. Mahon, W. G. Stelz, and J. L. Belli.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: $18.00 in paper copy, $2.50 in microfiche. Geological Survey Open-File Report 82-552, 1982. 5 Sheets, 15 Ref.

Descriptors: *Geologic mapping, *Groundwater, *Aquifers, *Groundwater movement, Aquifer characteristics, Well yield, Permeability, Groundwater level, Land use, Geohydrology, Hydrologic data, *New York, Monroe County, Soil permeability.

This report is last in a series of 11 map sets depicting geohydrologic conditions in selected aquifers in upstate New York. Geohydrologic data are compiled on five maps at 1:24,000 scale. Together the maps provide a comprehensive overview of a buried glacio-fluvial aquifer in Monroe County. The maps include surficial geology, geologic sections, bedrock topography, water-infiltration potential of soil zone, potentiometric surface altitude, and land use. The buried-valley deposits consist of ice-contact sand and gravel, till, and glaciolacustrine sand, silt, and clay. The sand and gravel have relatively high permeabilities whereas the till, silt, and clay deposits have relatively low permeabilities. Water-table conditions prevail in unconfined sand and gravel, whereas artesian conditions prevail in the northern part of the system within sand and gravel confined by silty deposits. Recharge occurs principally over the southern part of the aquifer, due to permeable land-surface conditions. Ground-water movement is towards the Irondequoit Bay and Lake Ontario, where discharge occurs. Several communities have wells capable of producing several hundred gallons per minute from the aquifer. The use of land overlying the aquifer is predominantly residential with lesser amounts of industrial uses. (USGS)
W83-00554

GEOHYDROLOGY OF THE VALLEY-FILL AQUIFER IN THE ENDICOTT-JOHNSON CITY AREA, BROOME COUNTY, NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
T. J. Holecek, A. D. Randall, J. L. Belli, and R. V. Allen.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver CO 80225. Price: $18.00 in paper copy, $2.50 in microfiche. Geological Survey Open-File Report 82-268, 1982. 5 Sheets, 5 Ref.

Descriptors: *Geologic mapping, *Groundwater, *Aquifers, *Groundwater movement, Aquifer characteristics, Well yield, Permeability, Groundwater level, Land use, Geohydrology, Hydrologic data, *New York, Broome County, Soil permeability.

This report is the tenth in a series of 11 map sets depicting geohydrologic conditions in selected aquifers in upstate New York. Geohydrologic data are compiled on five maps at 1:24,000 scale. Together, the maps provide a comprehensive overview of a major valley-fill aquifer in southwestern Broome County. The maps include surficial geology, geologic sections, aquifer thickness, water-infiltration potential of soil zone, potentiometric-surface altitude, and land use. The valley-fill deposits consist of alluvial silt and sand, glacial outwash (sand and gravel), ice-contact sand and gravel, till, and lacustrine silt and clay. The sand and gravel beds have relatively high permeabilities whereas the till, silt, and clay deposits have relatively low permeabilities. Water-table conditions are found in unconfined sand and gravel, whereas artesian conditions prevail within sand and gravel confined by silty deposits. Recharge occurs over the entire surface of the aquifer, due to permeable land-surface conditions, but is greatest along the margin of the valley, where runoff from the hillsides is concentrated, and near streams. The use of land overlying the aquifer is predominantly commercial and residential with lesser amounts of agricultural and industrial uses. (USGS)
W83-00555

GEOHYDROLOGY OF THE VALLEY-FILL AQUIFER IN THE RAMAPO AND MAHWAH RIVERS AREA, ROCKLAND COUNTY, NEW YORK,
Geological Survey, Albany, NY.
R. B. Moore, D. H. Cadwell, W. G. Stelz, and J. L. Belli.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225. Price: $21.50 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 82-114, 1982. 6 Sheets, 15 Ref.

Descriptors: *Geologic mapping, *Groundwater, *Aquifers, *Groundwater movement, Aquifer characteristics, Well yield, Permeability, Groundwater level, Land use, Geohydrology, Hydrologic data, *New York, Rockland County, Soil permeability.

This report is the eighth in a series of 11 map sets depicting geohydrologic conditions in selected aquifers in upstate New York. Geohydrologic data are compiled on six maps at 1:24,000 scale. Together, the maps provide a comprehensive overview of a major valley-fill aquifer in southeastern Rockland County. The maps include surficial geology, geologic sections, water-infiltration potential of soil zone, aquifer thickness, water-table elevations, well yields, and land use. The valley-fill deposits consists of alluvial silt and sand, glacial outwash (sand and gravel), ice-contact sand and gravel, till, and lacustrine silt and clay. The sand and gravel beds have relatively high permeabilities, whereas the till, silt, and clay deposits have relatively low permeabilities. Water-table conditions prevail in unconfined sand and gravel along the Ramapo River valley and much of the Mahwah River valley. Artesian conditions prevail in confined sand and gravel buried under silt and clay and till in parts of the Mahway valley. The aquifer is recharged throughout, where the land surface is most permeable and is greatest along the margin of the valley, where runoff from the hillsides is concentrated. The use of land overlying the aquifer is

predominantly commercial, agricultural and residential, with lesser industrial uses. (USGS)
W83-00556

BACKGROUND HYDROLOGIC INFORMATION IN POTENTIAL LIGNITE MINING AREAS IN MISSISSIPPI, AUGUST 1980,
Geological Survey, Jackson, MS. Water Resources Div.
J. K. Arthur.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225. Price: $2.75 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 81-421, 1981. 19 p, 4 Fig, 4 Tab.

Descriptors: *Hydrologic data, *Water quality, *Lignite, *Streams, Discharge measurement, Water sampling, Bottom sediments, Cross-sections, Low flow, Drainage area, *Mississippi.

The U.S. Geological Survey in cooperation with the Mississippi Bureau of Geology is conducting a hydrologic data collection program in the potential lignite producing areas in Mississippi. During the week of August 25-28, 1980, hydrologic data on channel characteristics were collected at 15 sites on small streams draining potential lignite mining areas in east central Mississippi. Current meter discharge measurements were made and water-quality samples were collected at 11 of the 15 miles. Main channel widths at sampling sites ranged from 126 feet on Sucarnoochee Creek to 15 feet on Houston Creek. Maximum water depth ranged from 7 feet on Pawticfaw Creek and Tallahatta Creek to one-half foot on Okatibbee Creek. The maximum stream discharge measured was 56 cubic feet per second on Pawticfaw Creek. Four sites had no discharge. Specific conductance at sampling sites ranged from 115 micromhos on Ponta Creek to 26 micromhos on Sucarnoochee Creek. The dissolved-oxygen concentration was 5.7 milligrams per liter or higher at all sites. The concentration of suspended sediment was not greater than 38 milligrams per liter at any site. Bottom material samples commonly contained iron, manganese and zinc. (USGS)
W83-00557

SURFACE-WATER AND CLIMATOLOGICAL DATA, SALT LAKE COUNTY, UTAH, WATER YEAR 1980,
Geological Survey, Salt Lake City, UT. Water Resources Div.
G. E. Pyper, R. C. Christensen, D. W. Stephens, H. F. McCormack, and L. S. Conroy.
Geological Survey Open-File Report 81-1111, 1981. 167 p, 1 Plate, 3 Tab, 3 Ref.

Descriptors: *Surface water, *Water quality, *Climatic data, *Data collections, Streamflow, Precipitation, Storm runoff, Chemical analysis, Sediments, *Utah, Salt Lake County.

This report presents streamflow, water-quality, precipitation, and storm-runoff data collected in Salt Lake County, Utah, during the 1980 water year and certain water-quality data for the 1979 water year which were included for comparative purposes. Surface-water data consist of daily mean values of flow at 33 sites on natural streams, canals, and conduits. Water-quality data consist of chemical, biologic, and sediment analyses at 30 sites. Precipitation data consist of daily and monthly total at nine sites. Storm-runoff data consist of 5 and 15-minute interval discharge data for storms of July 1-2, August 19, and August 25, 1980, for most surface-water sites. (USGS)
W83-00559

AN EVALUATION OF WATER-QUALITY MONITORING IN THE BRANDYWINE CREEK BASIN, PENNSYLAVANIA, 1973-78,
Geological Survey, Harrisburg, PA. Water Resources Div.
J. J. Murphy, J. R. Ritter, A. E. Brown, and J. P. Chiarella.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225. Price: $4.00 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 81-1115, February 1982. 28 p, 10 Fig, 4 Tab, 16 Ref.

Descriptors: *Water quality, *Streams, *Monitoring, *Data collections, Specific conductivity, Dissolved oxygen, Temperature, Hydrogen ion concentration, Streamflow, Water quality standards, *Pennsylavania, Brandywine Creek.

Data recorded from 1973 through 1978 by monitors on West Branch Brandywine Creek at Modena, East Branch Brandywine Creek below Downingtown, and Brandywine Creek at Chadds Ford were analyzed to evaluate the effectiveness of the monitors in describing water-quality conditions. The data show that the stream at Modena and below Downingtown had period of low dissolved oxygen, and that the stream below Downingtown had a particularly severe dissolved-oxygen deficiency from May through September 1974. The pH at all three sites exceeded 9.0 at times and the pH below Downingtown occasionally dropped below 6.0. The most critical period in the basin was from March to November when pH was most likely to exceed water-quality standards and dissolved oxygen was most likely to fall below the standards. Without the monitors, the extent and magnitude of these problems would not have been detected. (USGS)
W83-00560

HYDROLOGY AND CHEMICAL QUALITY OF GROUND WATER IN KIOWA COUNTY, COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
M. H. Mustard, and D. Cain.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: $25.25 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 81-1023 (WRI), 1981. 2 Sheets, 26 Ref.

Descriptors: *Groundwater, *Water quality, *Geohydrology, *Aquifers, Aquifer characteristics, Wells, Water level, Groundwater availability, Water use, Water supply, Potential water supply, Chemical analysis, *Colorado, Kiowa County.

Ground water is available in Kiowa County, Colo., in quantities suitable for municipal or irrigation uses from at least two aquifers, the Big Sandy-Rush Creek alluvial aquifer and the Ogallala aquifer. The Dakota Sandstone and the Cheyenne Sandstone Member of the Purgatoire Formation may provide marginally sufficient water for municipal or irrigation purposes. Whil e wells in parts of the Ogallala aquifer have shown significant water-level declines in recent years, the Dakota Sandstone and Cheyenne Sandstone Member of the Purgatoire Formation are virtually undeveloped in the county , primarily because of the depth to the top of these formations (500-1,00 feet). Where water is not available from the Big Sandy-Rush Creek and Ogallala aquifers in the county, supplies sufficient for domestic or stock use may be obtained from shallow wells in several minor aquifers. The quality of ground water in the county varies widely, but dissolved-solids concentrations are usually greater than 500 milligrams per liter, except in parts of the Ogallala aquifer. The water is generally very hard and sulfate concentrations are usually greater than 250 milligrams per liter, except in parts of the Ogallala aquifer. High concentrations of selenium (greater than 10 micrograms per liter) in three-fourths of the wells sampled and locally high concentrations of fluoride, nitrate, iron, and manganese limit the suitability of the ground water for municipal and domestic use. (USGS)
W83-00561

LOW-FLOW CHARACTERISTICS OF OHIO STREAMS,
Geological Survey, Columbus, OH. Water Resources Div.
D. P. Johnson, and K. D. Metzker.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver CO. 80225, Price: $37.75 in paper copy, $3.50 in microfiche. Geological Survey Open-Fi le Report 81-1195, 1981. 285 p, 11 Fig, 3 Tab, 15 Ref, 3 Append.

Descriptors: *Streamflow, *Low flow, *Hydrologic data, *Flow characteristics, Streams, Water supply, Waste assimilative capacity, Regulated flow, Base flow, Regression analysis, *Ohio, Stillwater River basin, Great Miami River basin.

Adequacy of streamflow for water supplies or waste water assimilation is commonly evaluated in terms of low-flow characteristics. This report presents annual and seasonal low-flow characteristics for 237 sites on regulated and unregulated streams in Ohio. In addition to compilation of site d ata, two regionalization methods--an analysis of base flow measurements and multiple regression analysis--were applied to test basins to determine the feasibility and accuracy of each me thod. An analysis of base flow measure ments (gain and loss studies) was made on the Stillwater River basin, with error ranging from -39 to 59%. Multiple regression analyses were made on the hydrologic data from the Great Mia mi River basin north of Dayton, which resulted in a standard error of estimate ranging from 110 to 138%. Through the use of an index of relative infiltration, the standard error of estimate was reduced to a range of 33 to 40%. (USGS)
W83-00563

GEOHYDROLOGY OF THE VALLEY-FILL AQUIFER IN THE JAMESTOWN AREA, CHAUTAUQUA COUNTY, NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
H. R. Anderson, W. G. Stelz, J. L. Belli, and R. V. Allen.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: $18.75 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 82-113, 1982. 7 Sheets, 7 Ref.

Descriptors: *Geologic mapping, *Groundwater, *Aquifers, *Groundwater movement, Aquifer characteristics, Well yield, Permeability, Groundwater level, Land use, Geohydrology, Hydrologic data, *New York, Chautauqua County, Soil permeability.

This report is the sixth in a series of 11 map sets depicting geohydrologic conditions in selected aquifers in upstate New York. Geohydrologic data are compiled on six maps at 1:24,000 scale. Together, the maps provide a comprehensive overview of a major valley-fill aquifer in southeastern Chautauqua County. The maps include surficial geology, geologic sections, water-infiltration potential of soil zone, aquifer thickness, potentiometric-surface elevations and land use. The valley-fill deposits consist of alluvial silt and sand, glacial-outwash (sand and gravel), ice-contact sand and gravel, till, and lacustrine silt and clay. The sand and gravel beds have relatively high permeabilities whereas the till, silt and clay deposits have relatively low permeabilities. Water-table conditions prevail in u nconfined sand and gravel beds along the valley margin. Artesian conditions prevail in confined sand and gravel buried under silt and clay in the middle of the valley. Recharge occurs mainly along the margin of the valley, where the land surface is highly permeable and runoff from the hillsides is concentrated. The use of land overlying the aquifer is predominantly agricultural and residential with lesser amounts of commercial and industrial uses. (USGS)
W83-00564

WATER USE IN THE MISSISSIPPI GULF COAST COUNTIES, 1980,
Geological Survey, Jackson, MS. Water Resources Div.
For primary bibliographic entry see Field 6D.
W83-00680

AVAILABILITY OF WATER FROM AQUIFERS IN UPSTATE NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
I. H. Kantrowitz, and D. S. Snavely.
Available from the OFSS, USFS Box 25425, Fed. Ctr. Denver, CO 80225, Price: $7.00 in paper copy, $1.00 in microfiche. Geological Survey Open-File Report 82-437, 1982. 2 Sheets, 41 Ref.

Descriptors: *Maps, *Groundwater availability, *Aquifers, *Well yield, Aquifer characteristics, Specific capacity, Groundwater management, New York, *Upstate New York.

Two maps give the locations and estimated yields of unconsolidated and bedrock aquifers of upstate New York, excluding Long Island. The map of surficial deposits give estimates of well yield, aquifer yield, and specific capacity; the map of bedrock units gives the same information and also delineates areas in which induced infiltration from streams into the bedrock and unconsolidated aquifers is possible. The maps are designed to assist planners in managing ground-water supplies. The maps represent data that were compiled in 1969 but not previously published. (USGS)
W83-00681

HYDROLOGIC DATA FROM TEST WELLS AND LOW-FLOW INVESTIGATIONS IN THE MIDDLE REACH OF THE EAGLE RIVER VALLEY, ALASKA, 1980-81,
Geological Survey, Anchorage, AK. Water Resources Div.
G. B. Deeter, and R. S. George.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price; $2.00 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 82-362, 1982. 13 p, 5 Fig, 3 Tab, 10 Ref.

Descriptors: *Hydrologic data, *Test wells, *Groundwater potential, *Low flow, Water quality, Potential water supply, Geology, Aquifer characteristics, Groundwater level, Observation wells, Water temperature, Data collections, Sites, Hydrographs, *Alaska, Eagle River valley.

Test wells and low-flow investigations in the Eagle River valley, Alaska, were used to evaluate the feasibility of developing ground water for a public supply. Aquifers capable of supplying large yield wells were not indicated in any of the drilling areas. The data include: results of low-flow seepage investigations at 22 river sites; geologic materials logs of eight test wells; water-quality data from two observation wells, two springs, and two river sites; and water level and temperature information for the observation wells and streams. (USGS)
W83-00682

DATA MANAGEMENT SYSTEM FOR URBAN HYDROLOGY STUDIES PROGRAM,
Geological Survey, NSTL Station, MS. Water Resources Div.
W. H. Doyle, Jr., and J. A. Lorens.
Available from the UFSS, USGS Bo 25425, Fed. Ctr. Denver, CO. 80225, Price: $36.00 in paper copy, $3.50 inmicrofiche. Geological Survey Open-File Report 82-442, 1982. 272 p, 18 Fig, 3 Tab, 6 Ref, 2 Append.

Descriptors: *Data collections, *Data storage and retrival, *Computer models, *Computer programs, Statistical analysis, Data transmission, Urban hydrology, Urban runoff, Storm water, Urban drainage, Rainfall-runoff relationships, Water quality.

A data management system was developed to store, update, and retrieve data collected in urban stormwater studies jointly conducted by the U.S. Geological Survey and U.S. Environmental Protection Agency in 11 cities in the United States. The data management system is used to retrieve and combine data from USGS data files for use in rainfall, runoff, and water-quality models and for data computations such as storm loads. The system is based on the data management aspect of the Statistical Analysis System (SAS) and was used to create all the data files in the data base. SAS is used for storage and retrieval of basin physiography, land-use, and environmental practices inventory data. Also, storm-event water-quality characteristics are stored in the data base. The advantages of using SAS to create and manage a data base are many with a few being that it is simple, easy to use, contains a comprehensive statistical package, and can be used to modify files very easily. Data base system development has progressed rapidly during the last two decades and the data managment system concepts used in this study reflect the advancement made in computer technology during this era. Urban stormwater data is, however, just one application for which the system can be used. (USGS)
W83-00683

GROUND-WATER LEVELS IN SELECTED WELL FIELDS AND IN WEST-CENTRAL FLORIDA, SEPTEMBER 1981,
Geological Survey, Tampa, FL. Water Resources Div.
D. K. Yobbi, and G. L. Barr.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: $7.00 in paper copy, $1.00 in microfiche. Geological Survey Open-File Map 82-261, 1982. 2 Sheets, 2 Ref.

Descriptors: *Potentiometric level, *Groundwater, *Maps, Subsurface water, Aquifers, Water table, Wells, Water level fluctuations, *West-central Floridan aquifer.

The water table in the surficial aquifer and the potentiometric surface of the Floridan aquifer in a 1,200-square-mile area in west-central Florida are mapped semiannually by the U.S. Geological Survey. Maps are based on water levels measured in wells each May to coincide with seasonal low levels and each September to coincide with seasonal high levels. The mapped area shows 14 well fields that supplied 140.3 million gallons to municipalities on September 21, 1981. The water is withdrawn from the Floridan aquifer, the major aquifer in Florida. The effect of localized withdrawal on ground water is shown on the maps as depressions in both the potentiometric and water-table surfaces. In September 1981, ground-water levels were significantly higher than those of May 1981 and were unchanged or within a few feet of those in September 1980. Seasonal recharge from summer rains and reduced pumpage are factors in the water-level recovery from record and near record low levels of May 1981. (USGS)
W83-00685

AQUIFER DATA FROM FOUR WELLS IN THE MENDENHALL VALLEY NEAR JUNEAU, ALASKA,
Geological Survey, Anchorage, AK. Water Resources Div.
G. O. Balding.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: $2.25 in paper copy, $4.00 in microfiche. Geological Survey Open-File Report 82-271, 1982. 14 p, 5 Fig, 6 Tab, 4 Ref.

Descriptors: *Groundwater, *Aquifers, *Data collections, *Water supply, Water quality, Observation wells, Drawdown, Pumping, Drillers logs, Geology, Glacial drift, Chemical analysis, *Alaska, Juneau, Mendenhall Valley.

This report summarizes data collected during drilling and testing of four wells in Mendenhall Valley, an area being developed as a suburb of Juneau, Alaska. Previous studies indicated that the glacial deposits on the east side of the valley had the potential for producing the large quantities of water needed for a community water supply. The drilling defined an upper aquifer between the water table and a depth of 215 feet and a lower aquifer below 252 feet. The testing did not define the storage coefficient or transmissivity of the upper aquifer. Drawdowns within 20 feet of the test well were less than 12 feet when the pumping rate was 300 gallons per minute. Greater pumping rates could be sustained in larger diameter wells having larger screened intervals in the upper aquifer but would produce greater drawdowns. The performance of the lower aquifer was not tested. Water in the upper aquifer is of adequate quality for drinking water, but may require treatment for iron; water from the lower aquifer is brackish. (USGS)
W83-00686

DATA ON SELECTED DEEP WELLS IN SOUTH FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
C. A. Smith, L. Lidz, and F. W. Meyer.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: $19.00 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 82-348, 1982. 144 p, 21 Fig, 4 Tab, 38 Ref.

Descriptors: *Hydrologic data, *Deep wells, *Artesian wells, *Groundwater, Aquifers, Potentiometric level, Water quality, Data storage and retrieval, Well data, Well logs, *Florida, South Florida, Floridan aquifer.

A data base of 870 deep wells was assembled for the south Florida part of the Southeastern Limestone Regional Aquifer Study. The data in this report are for wells in Broward, Collier, Dade, Hendry, Lee, Martin, Monroe, Palm Beach, and St. Lucie Counties. Data are compiled for water wells, oil test wells, injection wells, and monitor wells. These data consist of: (1) well identification and geographic location; (2) well construction and site use; (3) logs available (geologic and geophysical); and (4) selected water-quality parameters. The well locations are shown, by counties, on maps. The number of wells in each county are: Broward, 6; Collier, 237; Dade, 61; Hendry, 130; Lee, 226; Martin, 91; Monroe, 34; Palm Beach, 33; and St. Lucie, 52. Data are stored in the National Water Data Storage and Retrieval system (WATSTORE) in the following files: header, water-quality, and ground-water site inventory (GWSI). (USGS)
W83-00689

FLOOD DATA IN WEST WINDSOR TOWNSHIP, MERCER COUNTY, NEW JERSEY THROUGH 1981 WATER YEAR,
Geological Survey, Trenton, NJ. Water Resources Div.
D. A. Harriman, and A. J. Velnich.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver CO 80225, Price: $3.50 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 82-434, May 1982. 22 p, 1 Fig, 2 Tab, 5 Ref.

Descriptors: *Floods, *Flood data, *Flood peak, *Flood discharge, Streamflow, Gaging Stations, Data collections, *New Jersey, Mercer County, West Windsor Township.

Flood stages and peak discharges are described for 13 sites on streams in West Windsor Township, Mercer County, New Jersey, and surrounding areas, collected by the U.S. Geological Survey through the 1981 water year. Included are descriptions and elevations of floodmarks at 30 sites located by the West Windsor Township Environmental Commission after the September 25-27, 1975 flood. (USGS)
W83-00690

BACKGROUND HYDROLOGIC INFORMATION IN POTENTIAL LIGNITE MINING AREAS IN MISSISSIPPI, AUGUST 1981,
Geological Survey, Jackson, MS. Water Resources Div.
J. K. Arthur.
Available from the OFSS, USGS Box 25425, Price: $2.25 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 82-326, 1982. 16 p, 3 Fig, 4 Tab.

Descriptors: *Hydrologic data collections. *Water quality, *Lignite, *Coal mining, Streams, Low flow, Discharge measurement, Water sampling, Sites, Cross sections, Chemical analysis, Suspended sediment, Bottom sediments, Rural areas, *Mississippi.

The U.S. Geological Survey in cooperation with the Mississippi Bureau of Geology is conducting a hydrologic data-collection program in potential lignite-producing areas in Mississippi. During the period August 24-31, 1981, hydrologic data consisting of channel characteristics and stream discharge were collected at 18 sites, and water and channel bottom material samples were collected at 15 sites on small streams draining potential lignite mining areas in east-central Mississippi. Main channel widths ranged from 100 feet on Mill Creek near Louisville to 30 feet on Spring Creek near Bond.

Maximum water depths varied from 12.5 feet on Pawticfaw Creek to 0.2 foot on Beasha Creek. Three sites had no discharge. Specific conductance ranged from 100 micromhos on Lonsilocher Canal near Philadelphia to 24 micromhos on Jofuska Creek near Arlington. Water temperatures varied from 22.5 to 26 degrees Celsius. The highest pH was 7.6 on Fulton and Lonsilocher Canals. The dissolved oxygen concentration was 3.8 milligrams per liter or higher at all sites. Channel bottom-material samples commonly contained iron, manganese, and zinc. (USGS)
W83-00693

GROUND-WATER QUALITY IN EAST-CENTRAL IDAHO VALLEYS,
Geological Survey, Boise, ID. Water Resources Div.
D. J. Parliman.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver CO. 80225, Price: $11.50 in paper copy, $5.00 in microfiche. Geological Survey Open-File Report 81-1011, April 1982. 55 p, 9 Fig, 3 Plates, 6 Tab, 32 Ref.

Descriptors: *Groundwater, *Water quality, *Water quality standards, *Data collections, Baseline studies, Aquifers, Groundwater recharge, Groundwater movement, Wells, Well data, Chemical analysis, *Idaho, Lemhi Valley, Pahsimeroi Valley, Salmon River valley, Big Lost River valley, Little Lost River valley.

From May through November 1978, water quality, geologic, and hydrologic data were collected for 108 wells in the Lemhi, Pahsimeroi, Salman River (Stanley to Salmon), Big Lost River, and Little Lost River valleys in east-central Idaho. Data were assembled to define, on a reconnaissance level, water-quality conditions in major aquifers and to develop an understanding of factors that affected conditions in 1978 and could affect future groundwater quality. Water-quality characteristics determined include specific conductance, pH, water temperature, major dissolved cations, major dissolved anions, and coliform bacteria. Concentrations of hardness, nitrite plus nitrate, coliform bacteria, dissolved solids, sulfate, chloride, fluoride, iron, calcium, magnesium, sodium, potassium or bicarbonate exceed public drinking water regulation limits or were anomalously high in some water samples. Highly mineralized ground water probably is due to the natural composition of the aquifers and not to surface contamination. Concentrations of coliform bacteria that exceed public drinking water limits and anomalously high dissolved nitrite-plus-nitrite concentrations are from 15- to 20-year old irrigation wells in heavily irrigated or more densely populated areas of the valleys. Ground-water quality and quantity in most of the study area are sufficient to meet current (1978) population and economic demands. Ground water in all valleys is characterized by significant concentrations of calcium, magnesium, and bicarbonate plus carbonate ions. Variations in the general trend of ground-water composition (especially in the Lemhi Valley) probably are most directly related to variability in aquifer lithology and proximity of sampling site to source of recharge. (USGS)
W83-00694

GEOHYDROLOGY OF THE VALLEY-FILL AQUIFER IN THE ELMIRA AREA, CHEMUNG COUNTY, NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
T. S. Miller, A. D. Randall, J. L. Belli, and R. V. Allen.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: $25.00 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 82-110, 1982. 7 Sheets.

Descriptors: *Geologic mapping, *Groundwater, *Aquifers, *Groundwater movement, Aquifer characteristics, Well yield, Permeability, Groundwater level, Land use, Geohydrology, Hydrologic data, *New York, Chemung County, Soil permeability.

This report is the third in a series of 11 map sets decpicting hydrogeologic conditions in selected upstate New York aquifers. Geohydrologic data are compiled on seven maps at 1:24,000 scale. Together the maps provide a comprehensive overview of a major valley-fill aquifer in western Chemung County. Included are maps of surficial geology, geologic sections, soil-zone permeability, water-table altitude, aquifer thickness, estimated well yield, and land use. The maps are designed to enable the State to make decisions on waste-disposal plans that could adversely affect the aquifer and community water systems. (USGS)
W83-00695

GEOHYDROLOGY OF THE VALLEY-FILL AQUIFER IN THE CORTLAND-HOMER-PREBLE AREA, CORTLAND AND ONONDAGA COUNTIES, NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
T. S. Miller, T. D. Brooks, and W. B. Stelz.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: $25.00 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 81-1022, 1981. 7 Sheets.

Descriptors: *Geologic mapping, *Groundwater, *Aquifers, *Groundwater movement, Aquifer characteristics, Well yield, Permeability, Groundwater level, Land use, Geohydrology, Hydrologic data, *New York, Cortland County, Onandaga County, Soil permeability.

This report is the first in a seies of 11 map sets depicting geohydrologic conditions in selected aquifers in upstate New York. Geohydrologic data are compiled on seven maps at 1:24,000 scale. Together, the maps provide the first comprehensive treatment of the principal aquifer in western Cortland County. The set depicts surficial geology, geologic sections, soil permeability, water-table altitude, aqufier thickness, estimated well yield, and land use. The maps are designed to help planners evaluate underground waste-disposal practices. (USGS)
W83-00697

GEOHYDROLOGY OF THE VALLEY-FILL AQUIFER IN THE SPROUT AND FISHKILL CREEKS AREA, DUTCHESS COUNTY, NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
R. G. LaFleur, and R. B. Moore.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: $21.50 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 82-81, 1982. 6 Sheets, 13 Ref.

Descriptors: *Geologic mapping, *Groundwater, *Aquifers, *Groundwater movement, Aquifer characteristics, Well yield, Permeability, Groundwater level, Land use, Geohydrology, Hydrologic data, *New York, Dutchess County, Soil permeability.

This report is the fifth in a series of 11 map sets depicting geohydrologic conditions in selected aquifers in upstate New York. Geohydrologic data are compiled on six maps at 1:24,000 scale. Together the maps provide a comprehensive overview of a major valley-fill aquifer in southwestern Dutchess County and a small part of Putnan County. The maps include surficial geology, geologic sections, water-infiltration potential of soil zone, aquifer thickness, water-table elevations and land use. The valley-fill deposits consist of alluvial silt and sand, glacial-outwash (sand and gravel), ice-contact sand and gravel, till, and lacustrine silt and clay. The sand and gravel have relatively high permeabilities whereas the till, silt and clay deposits have relatively low permeabilities. Saturated layers of sand and gravel underlie confining layers of silt and clay, and also underlie confining till. The water-infiltration potential of the soil zone of the valley-fill varies widely. Aquifer thickness data is sparse, especially data on the lower confined aquifer layers. Water-table elevations within the surface aquifer are gently sloping, directing ground-water flow towards streams into which discharge occurs. The use of land overlying the aquifer is predominantly agricultural and residential, with lesser amounts of commercial and industrial uses. (USGS)
W83-00698

GEOHYDROLOGY OF THE GLACIOLACUSTRINE AQUIFER IN THE FULTON AREA, OSWEGO COUNTY, NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
H. R. Anderson, W. G. Stelz, and T. S. Miller.
Available from the OFSS, USGS box 25425, Fed. Ctr. Denver, CO 80225, Price: $18.75 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 82-83, 1982. 7 Sheets, 7 Ref.

Descriptors: *Geologic mapping, *Groundwater, *Aquifers, *Groundwater movement, Aquifer characteristics, Well yield, Permeability, Groundwater level, Land use, Geohydrology, Hydrologic data, *New York, Oswego County, Soil permeability.

This is the second in a series of 11 map sets depicting hydrogeologic conditions in selected upstate aquifers in upstate New York. Geohydrologic data are compiled on seven maps at 1:24,000 scale. Together the maps provide a comprehensive overview of the principal aquifer in western Oswego County. The set includes surficial geology, geologic sections, soil permeability, water-table altitude, aquifer thickness, estimated well yield, and land use. The maps are designed to enable planners to evaluate waste-disposal practices that may adversely affect the aquifer. (USGS)
W83-00699

WATER RESOURCES DATA FOR MARYLAND AND DELAWARE, WATER YEAR 1981.
Geological Survey, Towson, MD. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161. Geological Survey Water-Data Report MD-DE-81-1, 1982. 503 p, 5 Fig, 1 Tab.

Descriptors: *Hydrologic data, *Surface water, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Wells, Water level, Data collections, Sites, *Maryland, *Delaware.

Water resources data for the 1981 water year for Maryland and Delaware consist of records of stage, discharge, and water quality of streams; stage and contents of lakes and reservoirs; and water levels and water quality of ground-water wells. This volume contains records for water discharge at 120 gaging stations, stage and contents at 1 reservoir, water quality at 48 gaging stations and 74 wells, and water levels at 27 observation wells. Also included are data for 13 crest-stage, 62 low-flow, and 4 tidal crest-stage partial-record stations. Additional water data were collected at various sites not involved in the systematic data-collection program and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State, local, and Federal agencies in Maryland and Delaware. (USGS)
W83-00700

8. ENGINEERING WORKS

8A. Structures

PIPING POTENTIAL OF WEAK ZONES UNDER CONCRETE DAMS,
Bureau of Reclamation, Denver, CO.
G. A. Scott.
Journal of the Geotechnical Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 108, No GT3, p 488-493, March, 1982. 5 Fig, 1 Tab, 5 Ref.

Descriptors: *Concrete dams, *Dam foundation, Dam failure, Foundation failure, Dam stability, Methematical equations, *Piping potential.

Since high exit gradients theoretically exist at the downstream foundation contact of concrete dams, the piping potential of weak zones contacting the foundation in this area should be examined. A method is presented which has been used to evaluate the piping potential of shear zones crossing the foundation of a concrete dam from upstream to downstream. The method, which may also be applied to other conditions, involves determination of the critical exit gradient for the zone in question; determination of the exit gradient for the zone under reservoir conditions; and comparisons of the exit gradient under reservoir conditions to the critical exit gradient. Simple field tests can be used to determine the critical exit gradients for weak zones in concrete dam foundations. Simple calculations considering various depths of treatment concrete used to replace the weak material can be used to determine gradients under reservoir conditions, assuming uniformly isotrophic permeability and two-dimensional flow. The depth of treatment required to provide an appropriate factor of safety against piping can then be determined by comparing the critical exit gradient to calculated gradients for different treatment depths. (Carroll-FRC)
W83-00356

ABNORMAL BEHAVIOUR OF ZEUZIER ARCH-DAM (SWITZERLAND). II. ABNORMAL DAM DEFORMATIONS AND FIRST INVESTIGATIONS ABOUT THEIR ORIGIN,
O. Gicot.
Wasser, Energie, Luft, Vol 74, No 3, p 70-76, 1982. 6 Fig, 3 Ref.

Descriptors: *Deformation, *Dam failure, Arch dams, Concrete dams, Dam foundations, Dam stability, Zeuzier dam, Switzerland, Drainage effects, Tunnel construction, Reservoirs, Foundation rocks, Rocks, Cracks, Monitoring.

Part of a 7-paper series on the deformation of the Zeuzier Dam, Switzerland, this report contains early investigations of the problem. The dam, built in 1954-1957, has the following features: 156 m height, 256 m crest length, 7 m thick at the crest center, 25 m thick at the base center, total volume of 300,000 cu m. Routine monitoring of dam behavior included deflection measurements, temperature measurements of the dam and the air, and drainage and infiltration water flows in certain grouting galleries. Preceding the abnormal events in 1978, deformations had been elastic and drainage and infiltration had been reasonable. Monitoring equipment malfunctions, the exceptionally warm autumn, hysteresis, and earth tremors were ruled out as causes of the rock movements which were discovered in December of 1978. This left only the boring of the Rawil exploration tunnel for a roadway as a probable cause. After tunnel construction was stopped, the deformations stabilized. Analysis of monitoring data indicated that the abnormal movement had begun between September 1976 and September 1978. Inspection in March 1979 revealed opening of vertical joints and cracks in the downstream face, downstream exit galleries, inspection galleries, and dam crest. (Cassar-FRC)
W83-00363

ABNORMAL BEHAVIOUR OF ZEUZIER ARCH-DAM (SWITZERLAND), III. GEODETIC DEFORMATION MEASUREMENTS,
Schneider (Walter) Ltd., Chur (Switzerland).
K. Egger.
Wasser, Energie, Luft, Vol 74, No 3, p 76-80, 1982. 7 Fig, 4 Ref.

Descriptors: *Deformation, *Dam failure, *Measuring instruments, *Monitoring, Arch dams, *Concrete dams, Dam foundations, Dam stability, Reservoirs, Zeuzier Dam, Switzerland, Cracks, Stress analysis, Geodetic measurements.

Deformation measurements are the subject of this part of a 7-paper series on deformation of the Zeuzier arch dam, Switzerland. Geodetic measurements, a triangulation scheme downstream of the dam, showed little horizontal or vertical displacement of the dam between 1961 and 1976 (8 observations). The 1979 measurements indicated horizontal movement of all pillars in the observation network, a maximum of 71 mm upstream at the crest center. Vertical displacements reached 83 mm at the dam and less toward the valley slopes. A new geodetic scheme was designed to overcome the deficiencies of the old scheme, which did not cover a sufficiently large area and was unusable in winter. Additional pillars were erected upstream and downstream and a MeKometer ME 3000 distance measuring instrument installed. Preci se transverses installed in the control galleries were connected to the triangulation scheme. The new scheme also permitted measurements in individual sectors. Measurements made since 1979 indicate that movement has stopped. (Cassar-FRC)
W83-00364

ABNORMAL BEHAVIOUR OF ZEUZIER ARCH-DAM (SWITZERLAND), IV. GEOLOGICAL ASPECTS OF THE EXTRAORDINARY BEHAVIOUR OF ZEUZIER ARCH DAM,
T. R. Schneider.
Wasser, Energie, Luft, Vol 74, No 3, p 81-94, 1982. 10 Fig.

Descriptors: *Deformation, *Dam failure, Geology, Geohydrology, Seismic properties, Karst, Groundwater movement, Arch dams, Concrete dams, Dam foundations, Dam stability, *Zeuzier Dam, *Switzerland, Reservoirs, Monitoring, Tunnel construction, Drainage effects, Cracks, Arch dams.

The geological aspects of the Zeuzier arch dam are described as part of a series of 7 papers on deformation of this dam. The dam and reservoir are situated in the Helvetic nappe system of the Swiss Alps. The nappe is cut by several internal overthrusts and faults and exhibits some internal folding. Cycles of competent calcareous formations and incompetent marly formations alternate. The dam foundation rocks are Malm limestones surrounded by massive schist formations. The calcareous rocks are permeable, the marly series is rather impervious. Two groundwater systems exist. In the upper Malm limestones surface water circulates along fractures in a minor karst formation. The lower parts of the Malm limestones contain groundwater under pressure, with strong flows in summer and reduced flows in winter. Detailed instrumental, borehole, and water chemistry investigations revealed that the foundation rock was still in good condition and of low permeability and the grout curtain was intact. Evidence is presented to show that drilling the exploratory road tunnel was the cause of the rock deformations. The rock settlement corresponds with settlements due to lowering of groundwater table in soils. There is a geologic connection between the two, about 1400 m. The strongest deformation corresponded with the greatest drainage flows in the tunnel and with seasonal decreases in groundwater flow. Water chemistry indicated that water was draining from the lower groundwater system. Microseismic activity was detected shortly after the first major water inflow into the tunnel in September 1978. (Cassar-FRC)
W83-00365

ABNORMAL BEHAVIOUR OF ZEUZIER ARCH-DAM (SWITZERLAND) V. EXAMINATION OF CONDITION AND EVALUATION OF REPAIR METHODS,
Suiselectra Consulting Engineers, Basel (Switzerland).
A. R. Berchten.
Wasser, Energie, Luft, Vol 74, No 3, p 94-102, 1982. 10 Fig, 3 Tab.

Descriptors: *Deformation, *Dam failure, *Concrete technology, Arch dams, Concrete dams, Dam foundations, Dam stability, Zeuzier Dam, Switzerland, Reservoirs, Rehabilitation, Resins, Grouting, Cracks, Monitoring.

Examination of the condition on the Zeuzier arch dam, Switzerland, and evaluation of repair methods were considered in this paper, part of a series of 7 papers. The investigation was divided into 3 zones of interest: the grout curtain, the abutment (concrete-rock contact) and the dam body. Boreholes drilled into the grout curtain and water pressure tests revealed that the grout curtain was functional, the banks along the dam were impervious except at existing faults, the rock quality was good, and no new faults were detected. Similar tests on the abutment zone indicated that the cement-rock contact had been broken in places but was repairable. Lateral compression caused cracks in the dam body, starting at both extremities of the crest, extending down diagonally to near the base of the concrete, and then horizontally across the dam face near the bottom. Vertical joints also opened on the upstream face. Crack widths were a maximum of 15 mm, 4-7 mm in sections with parallel cracks, and < 5 mm in inspection galleries. Test cracks wider than 0.5 mm were repaired by injecting Rodur 510 and 512, epoxy resin based low and high viscosity materials. Tests on repaired c racks showed excellent bonding between injected epoxide and concrete. (Cassar-FRC)
W83-00366

ABNORMAL BEHAVIOUR OF ZEUZIER ARCH-DAM (SWITZERLAND) VI. STATIC CALCULATIONS,
W. Amberg, and G. Lombardi.
Wasser, Energie, Luft, Vol 74, No 3, p 102-109, 1982. 10 Fig, 1 Tab.

Descriptors: *Deformation, *Dam failure, Stress analysis, Arch dams, Dam foundations, Dam stability, Zeuzier Dam, Switzerland, Rehabilitation, Cracks, Concrete dams, Monitoring.

Three separate static calculation s were performed for the Zeuzier arch dam, Switzerland, in connection with its construction in 1954, the deformation observed in 1978-79, and repair plans. The findings are part of a 7-part report. The dam was deemed repairable if further deformations did not exceed 20% of previous movement. This decision was based on the excellent quality of the concrete, the confined nature of the highest stresses, the stress reduction caused by refilling, and the good quality of crack repair possible. Simulation analysis of the deformation on a cantilever in the central part of the wall showed the mechanism of the deflection of the top to the upstream side and the cracking. (Cassar-FRC)
W83-00367

ABNORMAL BEHAVIOUR OF ZEUZIER ARCH-DAM (SWITZERLAND) VII. PROGRAMS FOR REFILLING AND MONITORING,
Eidgenoessisches Amt fuer Wasserwirtschaft, Bern (Switzerland).
R. Biedermann.
Wasser, Energie, Luft, Vol 74, No 3, p 110-112, 1982. 2 Fig.

Descriptors: *Dam failure, *Deformation, *Monitoring, Reservoirs, Dam stability, Arch dams, Concrete dams, Stress analysis, Measuring instruments, Rehabilitation, Dam foundations, Cracks, Zeuzier Dam, Switzerland.

Refilling of the reservoir behind the Zeuzier arch dam, Switzerland, after crack repairs is described in the last of 7 papers on the deformation and repair of this structure. Four annual refilling stages have been selected: 1720, 1750, 1765, and 1777 m above sea level. The last value corresponds to the normal operating level. The water level will be kept at least 20 m below completed repair work, with increasing discharge in case of flood. The monitoring system includes water level recorder, thermometers, pendulums, a geodesic network, extensometers, rock meters, slope indicators, shear strips, groundwater inflow measuring stations, manometers, seismographs, and flow gaging stations for springs. The monitoring regime for each of the 4 filling cycles is divided into: new phase, drawdown phase in winter, and the refilling to previous level phase. (Cassar-FRC)
W83-00368

ABNORMAL BEHAVIOR OF ZEUZIER ARCH-DAM (SWITZERLAND) I. GENERAL VIEW,
Eidgenoessisches Amt fuer Wasser irtschaft, Bern (Switzerland).
R. Biedermann.

Wasser, Energie, Luft, Vol 74, No 3, p 65-70, 1982. 5 Fig.

Descriptors: *Deformation, *Dam failure, Arch dams, Concrete dams, Dam foundations, Dam stability, Zeuzier Dam, *Switzerland, Drainage effects, Reservoirs, Tunnel construction, Foundation rocks, Rocks, Monitoring, Cracks.

A general overview is presented, part of a 7-paper series, of the deformation problem of the 156 m high Zeuzier arch dam, Switzerland. In November 1978, after 21 years of normal operation, an upstream movement of the dam crest was monitored although the reservoir was nearly full. Neither temperature changes nor defects in the monitoring system were at fault so the water level was lowered to a minimum and a nearby road tunnel construction project was stopped. Subsequent investigations revealed that an extended homogeneous rock settlement was occurring. This caused dam settlement, a narrowing of the gorge, and a rotation of the rock found in the downstream direction. Movements increased until April 1979 and slowly declined thereafter. About 90% of expected movement has already taken place. As of the end of 1981 the dam had settled 11 cm and the upstream displacement of the crest was 11 cm. It was concluded that rock deformation had been caused by drainage effects of the exploratory tunnel. The dam is considered repairable if further settlement can be prevented. This situation forces a choice between repairing the dam and continuing the alpine road tunnel. Refilling is planned for 4 annual steps. This incident demonstrates the advantages of continuous monitoring for early detection of deformation. (Cassar-FRC)
W83-00508

PENSTOCK ENTRANCE RESEARCH-AUBURN DAM ENTRANCE,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
C. A. Pugh.
Bureau of Reclamation Report GR-828, August 1982. 22 p, 13 Fig, 1 Tab, 2 Ref.

Descriptors: *Penstocks, *Dam design, *Hydraulic design, *Hydraulic models, *Trash racks, Hydroelectric plants, Intakes, Model studies, Head loss, Design criteria.

In order to extend earlier value engineering concepts on the design of penstock entrances to dams with sloping faces and inclined penstocks, a penstock entrance design was developed for the Auburn Dam. A model of the Auburn Dam entrance was constructed on a 1:15.74 scale. The model included the penstock entrance, trashrack seat, circular-to-rectangular transition, and a 4.57-m prototype diameter penstock. The Auburn Dam penstock entrance design had excellent hydraulic characteristics. The design had low intake losses and acceptable pressures along the intake surfaces. The semicircular trashrack seat in front of the intake had a positive effect in reducing intake head losses and pressure drops along the intake surfaces. The compound radius bottom curve of the penstock entrance was very important in reducing losses in the inclined penstock. The results from this study in combination with earlier results from the Grand Coulee Third Powerplant model study can be used in the design of other low-velocity conduit and penstock entrances for dams having vertical faces and horizontal penstocks or sloping faces and inclined penstocks. (Moore-SRC)
W83-00638

8B. Hydraulics

BOUNDARY INTEGRAL SOLUTIONS OF WATER WAVE PROBLEMS,
Lehigh University, Bethlehem, PA. Dept. of Civil Engineering.
G. P. Lennon, P. L.-F. Liu, and J. A. Liggett.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 108, No HY8, p 921-931, August, 1982. 8 Fig, 9 Ref.

Descriptors: *Waves, *Tsunamis, Wave progagation, *Boundary Integral Equation Method, Sea bed, Seismic waves, Tidal waves, Numerical analysis, Submerged beds.

The Boundary Integral Equation Method is applied to three-dimensional, lineraized, transient water wave problems. This paper considers only the radiation problems concerning long waves (tsunamis) generated by an upthrust block of sea bed. Free-surface boundary conditions are applied to the still water level rather than the actual location of the free surface, forming a fixed boundary problem. A radiation boundary condition is used to truncate the computational domain. Solutions are given for 3 sample problems using a 4 ft x 8 ft upthrust block and different speeds of block motion: fast, transitional, and very slow (creeping). The numerical results obtained in this study agree reasonably well with previous analytical solutions. (Cassar-FRC)
W83-00463

CONVECTIVE RESPONSE OF A MASS OF WATER NEAR 4 C TO A CONSTANT COOLING RATE APPLIED ON ITS BOUNDARIES,
Montreal Univ. (Quebec). Dept. of Civil Engineering.
L. Robillard, and P. Vasseur.
Journal of Fluid Mechanics, Vol 118, p 123-141, 1982. 9 Fig, 22 Ref.

Descriptors: *Convection, *Cooling, Fluid mechanics, Rayleigh number, Water properties, Water cooling, Water circulation, Water temperature, Temperature, *Boundary conditions.

The convection of a mass of water confined in a closed cavity with a steadily decreasing wall temperature is considered through a dimensional analysis based on the assumption of a linear relationship between the thermal expansion coefficient and temperature. A quasi-steady state (constant velocity, flow pattern, and temperature difference between fluid and wall) can be reached provided that the cooling rate of the wall is constant for a sufficient period. The steady-state flow characteristics in the case of a specific geometry are functions of the Rayleigh number which uses a dimensionless temperature based on the cooling rate. For the case of water cooled through 3.98C, at which maximum density is observed, there is a linear relationship between the water thermal expansion coefficient and temperature and the cooling process, characterized by the Rayleigh number. Convective motion decreases as water is cooled toward 3.98C, at which it reverses and increases. Numerical results are given for the case of a square cavity. Experimental and numerical results are discussed for the case of a horizontal circular pipe. (Cassar-FRC)
W83-00512

A FOURIER METHOD FOR SOLVING NONLINEAR WATER-WAVE PROBLEMS: APPLICATION TO SOLITARY-WAVE INTERACTIONS,
New South Wales University, Kensington (Australia). School of Mathematics.
J. D. Fenton, and M. M. Rienecker.
Journal of Fluid Mechanics, Vol 118, p 411-443, 1982. 14 Fig, 4 Tab, 18 Ref.

Descriptors: *Wave propagation, *Fourier analysis, *Solitary waves, Wave pile-up, Fluid mechanics, Wave height.

A numerical method for solution of full nonlinear equations governing irrotational flow with a free surface and variable bed topography was applied to unsteady motion of nonbreaking waves over a horizontal bed. A truncated Fourier series and the finite difference method approximated the horizontal variation and the time variation, respectively. Study of the interaction of one solitary wave overtaking another showed that the Korteweg-deVries equation was applicable here because waves were long and low. One deviation from the theoretical was the significant growth of the overtaking high wave at the expense of the low wave. A mechanism was suggested to explain the observed forward phase shift of the high wave in wave interactions where the high, rear wave exchanges identities with the low, front wave before they have completely coalesced. The Fourier method also was used to study solitary waves traveling in opposite directions. Here there was a change of wave height and propagation speed proportional to the cube of the initial wave height but not contained in third-order theoretical results. With a solitary wave reflected by a wall the third-order theory was excellent for the maximum run-up at the wall but in error in the phase change of the wave after reflection. (Cassar-FRC)
W83-00514

THE DRIFT VELOCITY OF WATER WAVES,
Saint Andrews Univ. (Scotland). Dept. of Applied Mathematics.
A. D. D. Craik.
Journal of Fluid Mechanics, Vol 116, p 187-205, 1982. 31 Ref.

Descriptors: *Wave velocity, Fluid mechanics, Contamination, Physical properties, Viscosity, Water properties, Water currents, Drift.

Surface contamination of water, such as that caused by a surfactant, is shown to greatly enhance the drift velocity of short water waves. An initial value problem for drift current associated with temporally decaying waves is solved. The results resolve questions raised by the work of Liu and Davis, 1977. Calculation of the steady drift velocity of spatially decaying waves shows that it closely resembles the Longuet-Higgins conduction solution for unattenuated waves. It is also established that unidirectional drift currents of both surface and interfacial waves are unstable to spanwise periodic disturbances. (Cassar-FRC)
W83-00515

FLOW BENEATH A STAGNANT FILM ON WATER: THE REYNOLDS RIDGE,
Essex Univ., Colchester (England). Fluid Mechanics Research Inst.
J. C. Scott.
Journal of Fluid Mechanics, Vol 116, p 283-296, 1982. 6 Fig, 28 Ref.

Descriptors: *Surface flow, *Flow patterns, *Films, *Reynolds ridge, *Fluid mechanics, Ridges, Barriers, Surfactants, Organic matter, Streamflow, Compressibility, Flow velocity, Boundary layers, Turbulent flow, Stagnant water, Contamination.

The Reynolds ridge is a phenomenon observed in water-surface flow in nature and in the laboratory. This surface distortion, usually a barely discernible ridge, is formed when naturally-occurring organic surface active material both reduces the surface tension and imparts elastic properties to the surface, enabling it to resist compression. When this surface layer is trapped and compressed against a fixed shallow-draft object (for example, a twig in a stream) the surface becomes incompressible. The flow beneath the barrier forms a viscous boundary layer under the surface film, producing a distortion upstream of the obstruction. The ridge marks the boundary between regions of greater and lesser calm. The film-covered region near the obstruction suppresses the wind- and turbulent flow-excited surface disturbances more than the freely moving region does. Results of experimental measurements of the ridges in a flow channel apparatus agreed well with those predicted by a theoretical model (Harper and Dixon, 1974). Agreement was best at the highest flow velocities. At very low flow velocities the measured peak-slope difference was less than predicted. (Cassar-FRC)
W83-00516

8E. Rock Mechanics and Geology

REMEDIAL TREATMENT EXPLORATION, WOLF CREEK DAM, KY,
Army Engineer District, Nashville, TN.
M. D. Simmons.
Journal of the Geotechnical Engineering Division, Proceedings of the American Society of Civil En-

gineers, Vol 108, No GT7, p 966-981, July, 1982. 3 Tab, 8 Fig, 11 Ref.

Descriptors: *Dams, *Earthworks, *Karst, *Sinks, Grouting, Reservoirs, Design criteria, Seepage, Earth dams, Closed basins, Gravity dams, Limestone, Costs, Construction costs, Embankments, *Kentucky, Wolf Creek dam, *Underseepage, *Piping phenomena.

Remedial treatments to solve underseepage and piping problems related to the karstic foundation of Wolf Creek dam in Kentucky are described. Various exploratory techniques were used to assess the source of problems caused by development of a sinkhole at the downstream toe of the earth embankment. Direct subsurface information obtained from drilling and grouting was the most reliable. Following emergency grouting, a concrete diaphragm wall through the dam into the limestone foundation was chosen to correct the problem. Such a solution had never previously been attempted ahead of schedule, under bid price, and with no major problems during construction. Advantages to this procedure included the following: as holes were drilled and systematically backfilled, any voids in the embankment or foundation were immediately filled, and subsurface information was available to establish limits of the wall throughout the repair. (Titus-FRC)
W83-00651

8F. Concrete

PIPING POTENTIAL OF WEAK ZONES UNDER CONCRETE DAMS,
Bureau of Reclamation, Denver, CO.
For primary bibliographic entry see Field 8A.
W83-00356

8G. Materials

THE CONSTRUCTION OF THE MARCHWIEL RESERVOIR USING A HIGH DENSITY POLYETHYLENE LINING,
Wrexham and East Denbighshire Water Co. (England).
B. P. Reynolds, B. Bellis, and P. Reddington.
Journal of the Institution of Water Engineers and Scientists, Vol 36, No 3, p 234-238, May, 1982.

Descriptors: *Reservoir lining, *Plastics, *Polyethylene, Reservoir construction, Marchwiel Reservoir, *Wales, Linings, Sealants.

A high density polyethylene lining was installed at the Marchwiel Reservoir in Wales after site investigations showed that the proposed reservoir floor coincided with a brown silty clay strata. Clay suitable for sealing was not available on site. The poly ethylene sheeting was obtained in 10 m wide, 150 m long rolls. The plastic sheets were installed with a 150 mm overlap and sealed together by molten plastic of the same type. After reservoir filling, leakage was noted and was traced to 4 tiny defects in the seam welds. Stone-filled gabions were placed on the uppermost part of the slope to protect the plastic sheeting from sunlight, vandalism, and boats and to provide a surface for climbing out in case a person should fall into the water. (Cassar-FRC)
W83-00504

INSTALLATION OF FLEXIBLE MEMBRANE LINING IN MT. ELBERT FOREBAY RESERVOIR,
Bureau of Reclamation, Denver, CO. Applied Sciences Branch.
W. R. Morrison, E. W. Gray, Jr., D. B. Paul, and R. K. Frobel.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-265356, Price codes: A04 in paper copy, A01 in microfiche. Bureau of Reclamation Report REC-ERC-82-2, September 1981. 51 p, 48 Fig, 5 Tab, 6 Ref.

Descriptors: *Reservoir linings, *Membrane linings, *Forebays, *Seepage control, Linings, Pumped storage, Quality control, Inspection, Installation, Reservoir construction.

During the summer of 1980, approximately 117 ha of 1.14-mm CPER (reinforced chlorinated polyethylene) flexible membrane lining was installed in the Mt. Elbert Forebay Reservoir. The forebay reservoir and the Mt. Elbert Pumped-Storage Powerplant are part of the East Slope Power System of the Fryingpan-Arkansas Project. The installation constitutes the world's largest single-cell flexible membrane lining application to date, and is the first time that such a material has been used in a pumped-storage reservoir for seepage control. To meet the requirement for power online for the powerplant by July 15, 1981, the installation had to be accomplished in one construction season. Efficient handling and processing of earth materials were the keys to completing the job on schedule. The QA (Quality Assurance) Program was very effective. Probably the most valuable part of the QA Program was the field inspections, both factory and jobsite. The seam peel strength test for factory and field seams provided important information as to seam quality. Air lance testing proved to be a quick and effective method for checking the bonded overlap of seams. Field cutout samples proved to be a good check on the quality of the field seams. (Moore-SRC)
W83-00641

8I. Fisheries Engineering

AN ANALYSIS OF MESH SIZES REQUIRED FOR SCREENING FISHES AT WATER INTAKES,
Central Electricity Generating Board Southampton (England). Marine Biological Lab.
A. W. H. Turnpenny.
Estuaries, Vol 4, No 4, p 363-368, December, 1981. 3 Fig, 2 Tab, 4 Ref.

Descriptors: *Intakes, *Fish barriers, *Screens, *Mesh size, Powerplants, Cooling water, Mathematical equations, Estimating equations.

Twenty-four species of marine and fresh water fish were measured to determine optimal mesh sizes for fish screens. Samples were collected from cooling water intakes of power stations on the south coast of England, from trawlers, and from a hatchery. Curves relating fish length to mesh size requirements as a function of fish shape and size are given. A model for predicting mesh size requirements as a function of fish shape and size proved more accurate (7.3% mean deviation) than the Bell (1973) model (45% mean deviation). For species not included in the curves, the screen mesh size requirements can be estimated from an equation. (Cassar-FRC)
W83-00450

AN APPLIED COUPLED SIMULATION-OPTIMIZATION MODEL OF WATER USE EFFICIENCY IN INTENSIVE FISH CULTURE SYSTEMS,
Idaho Univ., Moscow. Dept. of Fishery Resources.
G. W. Klontz.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-125203, Price codes: A05 in paper copy, A01 in microfiche. Completion Report, Idaho Water and Energy Resources Research Institute, Idah University, Moscow, March 1982. 91 p, 5 Fig, 3 Tab, 111 Ref. OWRT A-063-IDA(1), 14-34-0001-0114.

Descriptors: *Water use efficiency, *Simulation analysis, *Computer models, Aquaculture, *Fish management, Trout, Mathematical studies, Optimization, Systems analysis, Model studies, Mathematical models, Fish farming, Aquatic life, Fisheries, Fish populations, *Idaho.

A bioenergetics modeling approach is presented which links the quantitative effects of the biotic and abiotic dependencies of aquaculture systems operation which impact on the allowable growth rate of the fish. The reported computer-implemented mathematical model addresses one of the significant aquaculture systems management limitations, that of production forecasting. The model predicts allowable growth rates and systems production. The conceptual framework of the model is not only applicable to the fish species (rainbow trout) from which it was developed, but is applicable to all aquaculture systems. Reparameterization of specific components results in valid models for other species. In order to develop the computerized systems model, it was necessary to identify the qualitative and quantitative interrelationships among major aquaculture system variables and to construct a quantitative model reflecting these interrelationships. Considered are: water characteristics, pond design, nutrition, waste products, feeding rates, and fish growth and activity. Use of the model in aquaculture operations for production forecasting would enhance operational efficiency and profit. Various applications of the model are discussed. (Zielinski-MAXIMA)
W83-00617

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